Manual of Aesthetic Design Practice

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Ministry of Transportation
and Highways

Highway Engineering Branch

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Foreword

This **Manual of Aesthetic Design Practice** represents the combined efforts of our engineers and technicians working with Roadside Development Staff and landscape architectural consultants, to produce a document that addresses landscape and aesthetic topics in the broadest and most fundamental sense.

The Ministry of Transportation and Highways is committed to designing and building highways that are the best they can be. This includes dealing with aesthetics from the inception of the highway design in a practical and sensible manner. This manual offers the process and the tools to accomplish this.

Its use throughout the highway design process will ensure full integration of aesthetic and engineering considerations, and the application of effective landscape design principles.

We eagerly support the use of the Manual and urge all persons involved in highway design to become familiar with the contents.

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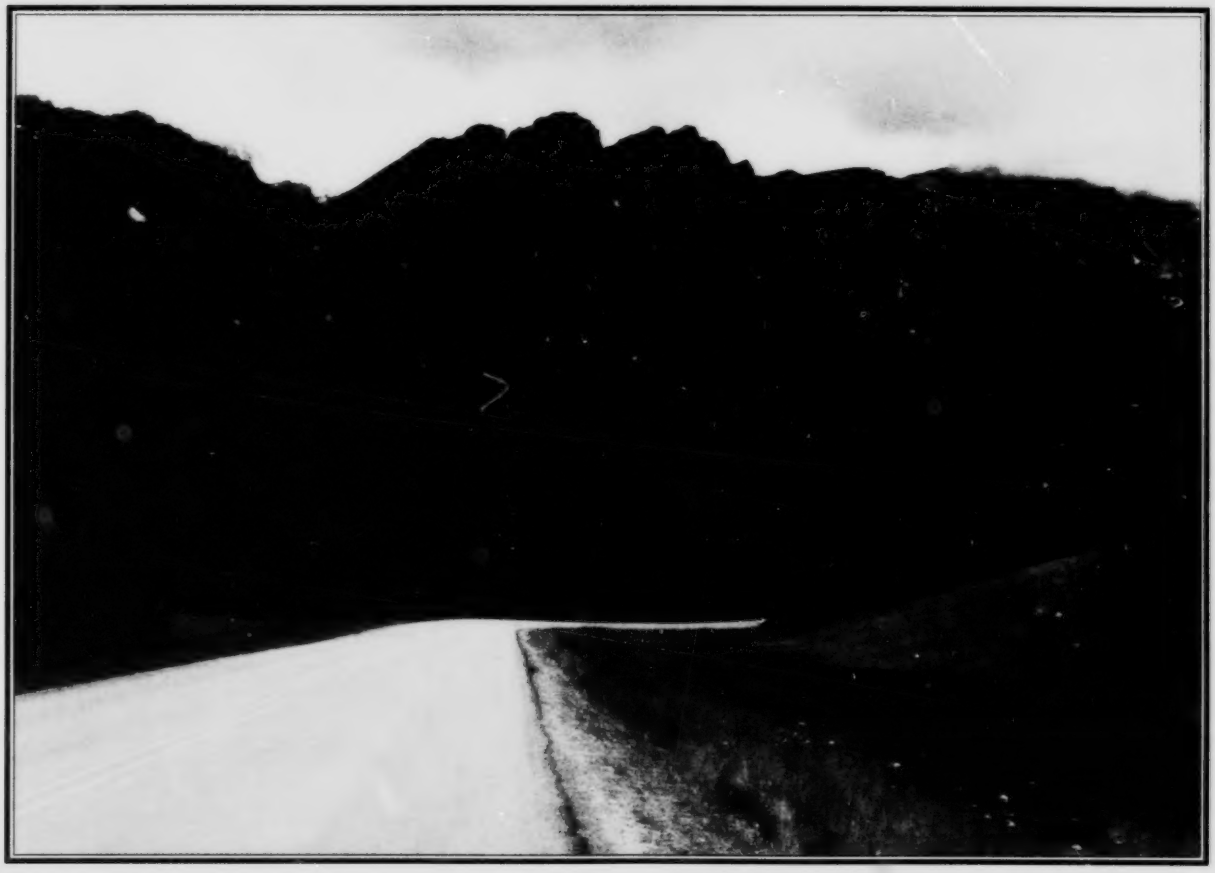


Introduction

Introduction

The Ministry of Transportation and Highways recognizes that the building of roads encompasses the efforts of a number of disciplines, each contributing to the quality and character of the finished product. An important aspect of this work includes the area of highway aesthetics.

The Province of British Columbia offers some of the most beautiful and spectacular terrain anywhere in the world. It also provides uncommon challenges and opportunities for highway construction; both for new highways that continue to open up vast undeveloped areas of the province, and for existing roads that require upgrading to meet the demands of a growing population.

This Manual of Aesthetic Design Practice addresses the design issues that affect the beauty and appeal of a highway corridor and contribute to the "complete highway" picture. By incorporating aesthetic design practices at all stages of highway development, from inception through to construction, we are able to take advantage of the landscapes that surround us and to deliver highways that have intrinsic values that complement, rather than intrude into the environment.

The application of the principles presented in this manual does not necessarily mean more cost to the public. To the contrary, there are distinct opportunities to not only refine certain design practices at no additional expense, but to realize returns from potentials such as increased tourism, and reduced maintenance requirements. In addition, the inclusion of aesthetic considerations into the overall project management of highways provides for greater design cost efficiency by integrating aesthetics with the basic engineering works, rather than treating them as expensive add-on solutions at a later date.

Many aesthetically oriented concepts stimulate the driver's senses and awareness of the surroundings, contributing to driver alertness and safety. Such observations are difficult to quantify, but there can be no doubt that people are influenced by such things as beauty, monotony, ugliness, and stress. Visual factors are the main determinant of aesthetic response, and also the element most readily controlled by highway designers.

British Columbia's reputation as a desirable place to live and visit is in large measure due to its scenic beauty, much of which can be appreciated from its highways. Beautiful highways can be part of this attraction. Boring and unappealing highways at best would be a lost opportunity.

Figure A-1
Most highways in British Columbia are built through areas of spectacular scenery. Highways which do not respond to this aesthetic context are a lost opportunity.

Figure A-2
Highways should strive to contribute positively to this aesthetic quality.

Examples of Aesthetic Design in Practice

Earthworks

Figure A-3
This pragmatic solution to controlling stormwater runoff is aesthetically unacceptable.

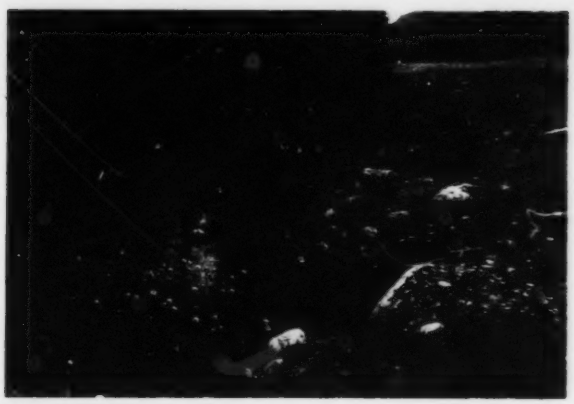


Figure A-4
This culvert outflow has been constructed to create an effective and well concealed transition between the pipe and stream.

Figure A-5
In this example earthworks have been designed to minimize headlight glare and simulate adjacent topography.

Revegetation

Figure A-6
All areas within the highway right of way must be designed and maintained to create an attractive and orderly image. This area between a highway and frontage road looks unfinished and invites abuse through littering and off-road traffic.

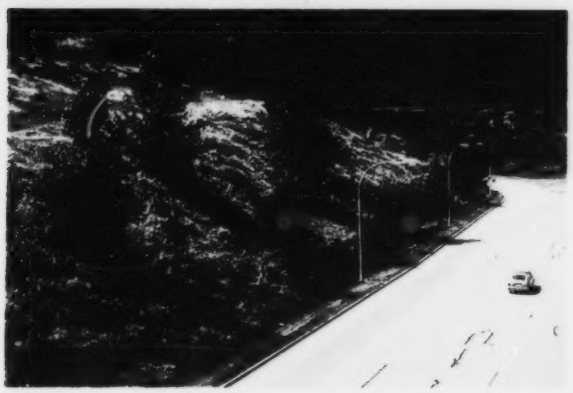


Figure A-7
The treatment of roadsides and medians should be simple and responsive to the character of the adjacent topography.

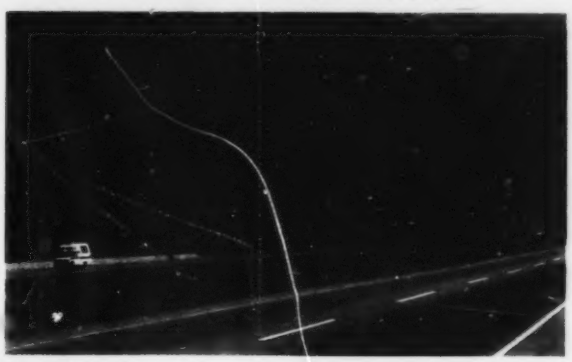


Figure A-8
In this example existing vegetation has been retained within the median reducing revegetation costs and maintaining visual continuity with the adjacent countryside.

Figure A-9
This manual is written to respond to the broad range of conditions evident throughout B.C.

How to Use This Manual

The Manual of Aesthetic Design Practice is intended for use by all Highways personnel and consultants involved with the planning, design, or construction management of highways in British Columbia. To be effective the practices outlined in this manual must be supported at all levels of decision making and be incorporated throughout the design process, from project inception to construction.

The Manual is organized into sections which follow the general sequence of activities and/or tendering in a typical highway design project. Sections include:

- Introduction
- Aesthetic Design Method
- Aesthetic Classification System
- Visual Resource Management
- Alignment
- Clearing and Grubbing - Vegetation Management
- Earthwork
- Revegetation - Vegetation Management
- Structures
- Roadside Facilities
- Above Ground Utilities

The recommended approach for users of the Manual is as follows:

Read through and be familiar with the Introduction, the Aesthetic Design Method, and the Aesthetic Classification System.

Review the balance of the manual to become familiar with the scope and general intent of the document. From this overview it will be possible to focus on the Section(s) which apply to your most immediate concerns without losing sight of the overall context. Cross references to other sections are indicated in italics. These references indicate where you should be aware of a related point under another chapter.

It is important to be aware that the success of this design approach is dependent upon the coordinated efforts of all those involved with a project. Effective aesthetic solutions can only be achieved through a coordinated integration of all aspects of a highway design. Such an integrated solution will require designers of various aspects of the highway to develop ideas concurrently and co-operatively.

The Manual of Aesthetic Design Practice is written to apply to rural highways through virgin territory. This has been done for the sake of clarity and simplicity. Many, but not all, of the principles introduced herein will apply to highway improvement projects and to suburban highways.

This manual is written to deal with the fundamentals of good design which will be universally applicable. It is outside of the scope of this manual to address issues related to specific or unique site conditions. For more information relating to specific developments please refer to the Ministry's Landscape Policy which defines 'Rural', 'Suburban', and 'Urban' landscape conditions and outlines Ministry Landscape Standards, many of which deal with landscape matters at the level of detail design.

For additional information contact the appropriate Roadside Development Office, or the Roadside Development Section of Highway Engineering in Victoria.

Aesthetic Design Method

The following flowchart illustrates and summarizes the sequence of highway design and identifies specific activities involved in incorporating aesthetic design principles at each stage of highway development.

The stages identified across the top of the chart correspond with the successive levels of design from project identification through to the design and development of roadway structures, roadside facilities, and above ground utilities.

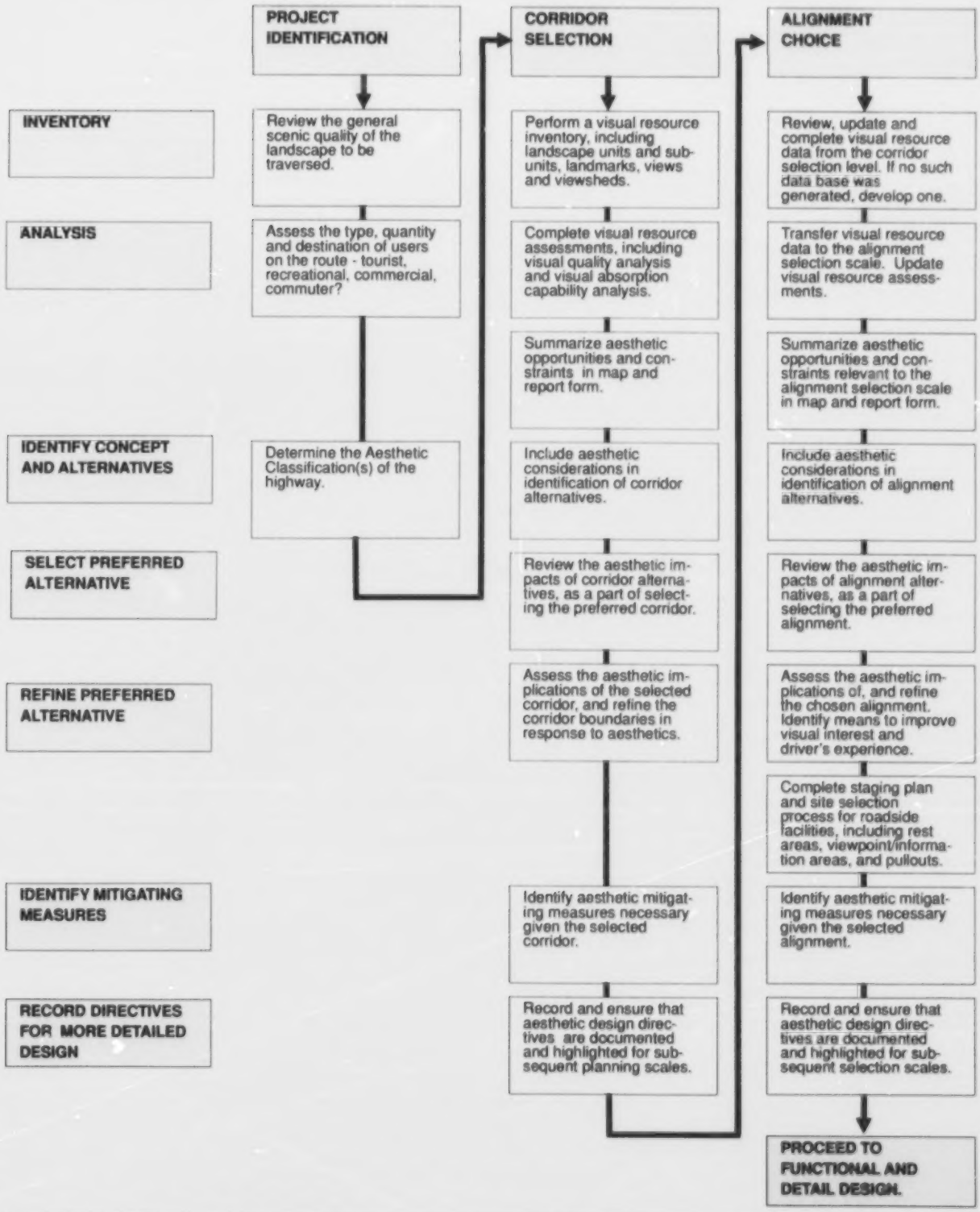
The divisions along the left side identify tasks that must be completed for each successive level of design refinement.

Designers involved in highway development projects will be able to use this flowchart to locate their specific involvement within the context of the aesthetic design methodology and refer directly to the parts of this manual which refer to their particular needs.

This flowchart provides a graphic summary of the contents of this manual. It offers a useful reference as an initial overview of the complete aesthetic design process, as well as a map locating individual tasks within the context of the overall process.

Aesthetic Design Method

Preliminary Engineering Stage


PROJECT IDENTIFICATION
CORRIDOR SELECTION
ALIGNMENT CHOICE
INVENTORY
Review the general scenic quality of the landscape to be traversed.
Perform a visual resource inventory, including landscape units and sub-units, landmarks, views and viewsheds.
Review, update and complete visual resource data from the corridor selection level. If no such data base was generated, develop one.
ANALYSIS
Assess the type, quantity and destination of users on the route - tourist, recreational, commercial, commuter?
Complete visual resource assessments, including visual quality analysis and visual absorption capability analysis.
Transfer visual resource data to the alignment selection scale. Update visual resource assessments.
Summarize aesthetic opportunities and constraints in map and report form.
Summarize aesthetic opportunities and constraints relevant to the alignment selection scale in map and report form.
IDENTIFY CONCEPT AND ALTERNATIVES
Determine the Aesthetic Classification(s) of the highway.
Include aesthetic considerations in identification of corridor alternatives.
Include aesthetic considerations in identification of alignment alternatives.
SELECT PREFERRED ALTERNATIVE
Review the aesthetic impacts of corridor alternatives, as a part of selecting the preferred corridor.
Review the aesthetic impacts of alignment alternatives, as a part of selecting the preferred alignment.
REFINE PREFERRED ALTERNATIVE
Assess the aesthetic implications of the selected corridor, and refine the corridor boundaries in response to aesthetics.
Assess the aesthetic implications of, and refine the chosen alignment. Identify means to improve visual interest and driver's experience.
Complete staging plan and site selection process for roadside facilities, including rest areas, viewpoint/information areas, and pullouts.
IDENTIFY MITIGATING MEASURES
Identify aesthetic mitigating measures necessary given the selected corridor.
Identify aesthetic mitigating measures necessary given the selected alignment.
RECORD DIRECTIVES FOR MORE DETAILED DESIGN
Record and ensure that aesthetic design directives are documented and highlighted for subsequent planning scales.
Record and ensure that aesthetic design directives are documented and highlighted for subsequent selection scales.
PROCEED TO FUNCTIONAL AND DETAIL DESIGN.

Aesthetic Design Method

Functional and Detail Design Stage

	CLEARING & GRUBBING	EARTHWORK	REVEGETATION
PRELIMINARY CONCEPT AND CONTOUR SURVEY	Identify & review aesthetic objectives from previous planning, and transfer visual resource data to detail design scale.	Review aesthetic objectives from previous planning, including aesthetic class, visual objectives, and mitigating measures eg. earthwork buffers.	Identify and review aesthetic objectives from designs, including aesthetic class, visual objectives, vegetation buffer areas, selective clearing.
	Include required mapping for aesthetic planning in contour survey, e.g.existing vegetation, terrain and landmarks.	Review typical cross section standards re: medians, ditching, cut/fill heights & slopes, walls, traffic barriers, rock cuts, driver's experience.	Identify landscape standard(s) which apply, whether urban, suburban, or rural. Note policies for topsoil, irrigation, planting standard.
FUNCTIONAL DESIGN	Develop clearing and grubbing design concept, including potential vegetation retention (buffer)areas, selective clear areas, and disposal areas.	Review and refine centreline profiles and cross sections to incorporate aesthetic objectives and mitigation measures.	Produce revegetation concept, showing safety setbacks, views, buffers, plant massing, bioengineering, typical species and soil depth, cost.
		Identify borrow areas/construction yards/topsoil stockpile areas and provide for integration with roadway design and vegetation buffers.	Refine design at detailed scales for landscape at interchanges, bridges, medians, walls, tunnels, toll plazas, and roadside facilities.
CONTROL LINE SURVEY (or concurrent task)	Flag vegetation buffer or selective clear areas in the field and survey these areas during control line survey.	Ensure that survey cross sections and contour plans extend to include limits of earthwork/vegetation areas as determined by aesthetic objectives.	Flag and survey vegetation to remain (as per clearing and grubbing).
DETAIL DESIGN	Monitor the highway design process to ensure protection of vegetation buffer and selective clear areas.	Incorporate aesthetics into detail earthwork design. Include provision of retaining walls or bio engineering where warranted.	Produce detail design and plant list with quantities for trees, shrubs, groundcovers, sodded areas, seeded areas, bioengineering.
	Identify right of way or easement boundaries to include vegetation buffers or selective clear areas.	Produce aesthetic contour grading plans, for bridges, overpasses, interchanges, avalanche barriers, berms and roadside facilities.	Produce irrigation plans if applicable. Incorporate required sleeves under paving into earthwork or roadway plans.
	Incorporate vegetation buffers or selective clear areas into clearing and grubbing plans and specifications, including tree protection specs.	Coordinate earthwork design to respect buffer/selective clear areas, roadside facilities, slope rounding and warping, & other aesthetic needs.	Produce detailed supplementary specifications for landscape, irrigation, selective clearing, and bioengineering works.
BUDGETING	Ensure that all periodic and final budget reviews allow for vegetation buffer and selective clear areas.	Ensure that all periodic and final budget reviews allow for earthwork aesthetic treatments.	Ensure that all periodic and final budget reviews allow for revegetation. Include both capital and first year maintenance cost in final budget.
COORDINATION	Ensure coordination of vegetation buffer and selective clear areas with other aspects of design, e.g. earthworks, utilities.	Update clearing & grubbing plans to match final earthwork plans. Coordinate with structure plans and elevations.	Ensure co-ordination of revegetation with clearing & grubbing, earthworks, roadway structures, and roadside facility design.

ROADWAY STRUCTURES	ROADSIDE FACILITIES	ABOVE GROUND UTILITIES
Identify and review aesthetic objectives for previous designs, including aesthetic class, viewpoints, recreation amenities and structures.	Review aesthetic objectives, including aesthetic class, Provincial Roadside Facility Program, roadside facility staging and site selection plans.	Identify and review aesthetic objectives from previous designs, including aesthetic class, existing and planned utilities, routing and screening policy.
Identify related structures which might be incorporated into an integrated design e.g. bridges & approach walls. Extend survey at structure sites.	Ensure that contour survey includes proposed or potential roadside facility areas. Detailed contour interval should be provided.	Ensure that locations of all existing or planned above ground utilities within view of the road are included in contour survey.
Produce detailed site plans and grading plans at structures to integrate the structure into the adjacent terrain and vegetation.	Produce and refine site plan concept, including conceptual access road/parking layout, grading, building siting and walkways, related costs.	Coordinate with utility companies or municipalities to maximize shared poles and minimize above ground clutter of utilities.
Produce design elevation drawings of structures, showing relationships to adjacent grades, vegetation, and scale in relation to the structure site.	Field review site plan concept, and refine accordingly. Finalize approvals for utility supply and road access.	Determine routing of utility lines, with aesthetic class and views in mind. Identify route locations requiring buffering.
Complete a design refinement process including review(s) by professionals trained in aesthetics.	Produce detail design of access road and parking, including geometrics, profiles, integration with adjacent grades/ vegetation.	Ensure that control line survey and cross sections include routings for visible utilties.
Ensure design aesthetics are implemented during detail and structural design.	Complete overall site plan , grading plan, and revegetation plan. Refine access road and parking design as necessary for co-ordination.	Coordinate detail design of utilities to meet aesthetic objectives. Include aesthetic considerations in lighting plans.
Select construction finish materials to meet the colour and texture objectives set out by the aesthetic class of the highway.	Produce architectural plans and details for buildings on the site. Produce utility plans and profiles. Coordinate with site/landscape plans.	Review in detail kiosks, pylons, gooseneck vents, or other utilitarian structures to minimize aesthetic impacts by location or design.
Concentrate design effort on visual vertical details of the structure, e.g. wall faces, handrails, traffic barriers, lighting.	Finalize working drawings and supplementary specs for layout, grading, planting, irrigation, clearing and grubbing.	Review all utility routings to ensure that areas of existing vegetation to remain, or significant views are not impacted. Refine accordingly.
Ensure that all periodic and final budget reviews allow for structure aesthetic treatments.	Ensure that all periodic and final budget reviews allow for roadside facility development.	Ensure that all periodic and final budget reviews allow for aesthetic treatment of above-ground utilities.
Ensure co-ordination of earthworks, drainage and erosion control, and revegetation with structure design.	Ensure co-ordination of roadside facility location and access roads with overall highway spacing, laning, profiles and earthwork plans.	Ensure co-ordination of above ground utilities with clearing & grubbing, earthwork, revegetation, roadway structure and roadside facility plans.

PROCEED TO TENDER CALL AND CONSTRUCTION

Aesthetic Classification System

Aesthetic Classification System

All highways in B.C. will be assigned one of three aesthetic classifications. These classifications will guide the priority given to aesthetic management. All highways will be managed to provide at least the minimum aesthetic treatment as outlined herein.

Baseline Highway

Baseline Aesthetic Highways are those roads carrying unrestricted commercial traffic requiring only baseline aesthetic treatment and/or all roads not earmarked for Tourway, or Parkway aesthetic treatment.

- All highways will be required to be developed to a baseline aesthetic standard, so as to best accommodate future upgrading to any RAU or RAD traffic classification.*
- All policies in this document apply to the Baseline Highway unless otherwise indicated in the text.

Tourway

Aesthetic Highways, now defined as Tourways are roads or portions of roads carrying unrestricted commercial, high volume commuter, and/or tourist traffic qualifying for premium aesthetic treatment.

- Highways passing through or adjacent to parks, ecological reserves, recreation areas, resort areas, or wilderness preserves.
- Highways with high percentages of tourism and recreation oriented traffic.
- Design speeds may fall under any RAU or RAD traffic classification.*

Parkway

Parkway aesthetic highways are roads through parks, ecological reserves, recreation areas and resort areas not carrying high volume commercial and commuter traffic.

- Priority will be given to the recreational driving experience and aesthetics.
- Some restrictions on commercial traffic may apply.
- Design speeds will fall under traffic classifications RAU 90, RAD 90 or lower. In general, parkways will have relatively low design speeds, to allow a higher appreciation of the road and its surroundings.*

**Note: The RAU (Rural Arterial Undivided) and RAD (Rural Arterial Divided) traffic classifications referred to in the text provide guidance as to the highway design speeds which are anticipated within these three aesthetic classifications. These classifications are required only where specific highway design speeds are required to accommodate certain aesthetic guidelines.*

Figure B-1
Example of a rural Baseline Highway.

Figure B-2
Example of a Tourway in a rural setting

Figure B-3
Example of rural Parkway

Visual Resource Management

Visual Resource Management

Introduction

Visual factors are important to highways in two ways:

- the view **from** the road
- the view **toward** the road

The view **from** the road may either be pleasant, or unattractive and monotonous. In both situations the finished product can be improved through visual resource analysis techniques.

The view **toward** the road is often associated with negative reactions from adjacent landusers and the general public. The role of the highway designer is to minimize the negative impact of the road on the physical landscape and on the scenic beauty of that landscape.

Highway engineers must respond to these two issues in order to create a highway which can offer an enjoyable experience to the driver, and at the same time minimize the negative visual impact on the landscape as seen from off the highway.

Aesthetic highway design must therefore continuously manage design alternatives from these two points of view.

Recommended Practices

The following pages outline recommended practices to be applied to all highways in B.C., as summarized below:

1.0 Visual Resource Management techniques as outlined in this document will be applied to all new highway projects in B.C.

2.0 Visual resource inventory will be completed during the corridor and/or alignment selection stage.

3.0 Visual landmarks seen from the potential highway area will be mapped and considered during corridor and/or alignment selection.

4.0 Significant views affected by the proposed highway, and potential viewpoints to be created by the highway, will be mapped and evaluated during corridor and/or alignment selection.

5.0 Assessment of relative visual quality of landscape units will be performed during corridor and/or alignment selection

6.0 Assessments of Visual Absorption Capability for the landscape units will be evaluated during corridor and/or alignment selection.

7.0 Preliminary corridor assessment and alignment selection will include an evaluation of the visual interest provided for the driver.

8.0 Visual Resource Management considerations will be integrated into the highway design process in parallel with other considerations, from the time of project identification through to completion of construction.

1.0 Scope of Visual Resource Management

Visual Resource Management techniques as outlined in this document will be applied to all new highway projects in B.C.

Visual Resource Management recognizes that "the visual environment is a resource; one needful of as much recognition, identification, classification and management as other resources. It is important that it be assessed at all planning levels to include its sensitivity, possible deterioration and/or its capability for recovery from visual impacts generated by development activities." (Yeomans, 1983)

The scope of Visual Resource Management for highway development should include everything that is seen in the view **from** the road, or in the view **toward** the road. This comprehensive scope means that the visual aspects of highways planning extend throughout the highway planning process, from the project identification and corridor selection scales, through geometric alignment, right of way and detail design.

Visual resource management would follow a process of:

- Recognition of **Landscape Type**.
- Mapping of **Landscape Units** - **areas** of homogeneous visual character.
- Mapping of **Landmarks** - points of visual interest.
- Mapping of **Views** - both existing and potential, fleeting and panoramic.
- Assessment of **Visual Quality** - comparing the relative value of visual features.
- Assessment of **Visual Absorption Capability** - comparing the relative adaptability of various landscapes to absorb visual change.
- Assessment of **Visual Interest (Driver's Experience)** - reviewing the level of variety, interest or monotony presented by the highway to the driver and passengers.
- **Incorporation of Guidelines into Highways Design** - coordinating with other disciplines in the planning process; from concepts for route selection through to detail design and construction.

Note: Visual Resource Management should be performed by a Landscape Architect, or related professional, with training in resource analysis, aesthetics and visual assessment. This expertise should be supplemented with a public participation program to confirm or refine the professional judgments involved.

Refer to Yeomans, Visual Resource Assessment - A User Guide, B.C. Ministry of Environment, 1983 for a complete definition of terms and techniques.

Figure C-1
An attractive view from the road.

Figure C-2
View toward the road.

Figure C-3
The mountains in B.C. present both a spectacular visual opportunity, and a construction challenge.

2.0 Landscapes of British Columbia

Visual resource inventory, including a description of areas of homogeneous visual character, will be completed during corridor and/or alignment selection.

Landscape mapping should be undertaken to identify distinct visual landscapes through which proposed highway corridors will pass. At a general scale the mapping undertaken to identify 'Landscapes for B.C. Parks' by the B.C. Ministry of Parks identifies landscape types which will be visually evident. However each of these landscapes will include areas of different aspect, slope, and vegetation type and additional, more detailed information will be required for highway planning purposes.

Landscape mapping undertaken in greater detail will identify landscape units within each of the landscape types. **Landscape units** are "areas of homogeneous visual character" based on the sum of: landform, land use, vegetative cover, and water cover.

Where these factors have the same qualities and patterns over an area they will create an area of homogeneous visual character. Boundaries between landscape units will typically follow watershed boundaries. There will frequently be several landscape units within a watershed.

A further level of gradation will be appropriate for the analysis of highway corridors. **Landscape subunits** are subtle variations from the general visual character of the landscape unit. These subunits will be the sum of small scale variations in vegetation, topography, or land use which change the visual appearance of the landscape. Landscape subunits will generally be evident at a mapping scale of 1 : 50 000 to 1 : 20 000.

Visual resource mapping will also note the locations of **"edges"** between landscape units. These edges will be evident as areas of pronounced visual change.

The purpose of mapping **landscape units, landscape subunits** and their **"edges"** is to summarize in map form the visual character of the landscape. Also, inherent to the mapping of landscape units is that related factors such as wildlife, soils, slope and land ownership will be revealed. Astute use of this information as applied through the following practices can lead to the creation of cost effective, safer, and more scenic highways.

Figure C-4
Landscape typical of the Cariboo interior.

Figure C-5
Landscape typical of northern B.C.

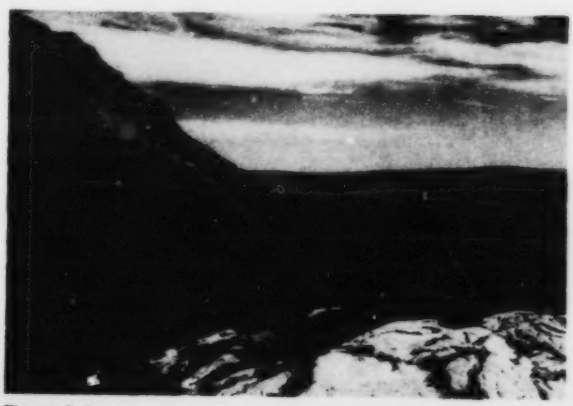


Figure C-6
Landscape 'edges' can be dramatic. Note the two distinct landscape units in this photograph.

Figure C-7
Landscapes of British Columbia.
B.C. Ministry of Parks (June 1990)

Highway design practices in response to landscape units should:

- Avoid landscape units which have high visual value and sensitivity. For example, a landscape unit with a complex mix of lakes, steep mountainsides and homogeneous coniferous forest will be both beautiful and unforgiving of major highway construction. The ideal location for a highway relating to such a landscape unit would be close to, or overlooking the unit, but not through it. By being close, visual access and secondary road access for recreation could be provided, without excessive impacts on the high value landscape unit.

- Manipulate a road corridor and alignment to cross over landscape unit edges. This technique could increase visual variety and interest, and lead to heightened awareness by drivers of their surroundings.

- Add man-made points of interest where large landscape units might lead to monotony and driver fatigue. Techniques to provide visual interest in an otherwise nondescript setting include:

  - location of rest areas
  - changes in alignment from tangents to curves
  - changes in median cross section
  - special attention to structures like bridges and overpasses
  - vegetation management by leaving treed areas within the right of way or adding plantings.

- Create a roadway which responds to the landscape unit in alignment and cross section details, by use of split level medians or separate one-way alignments.

- Mitigate visual impacts on the landscape unit, by careful selective clearing, leave strips, slope retaining devices, careful grading and revegetation.

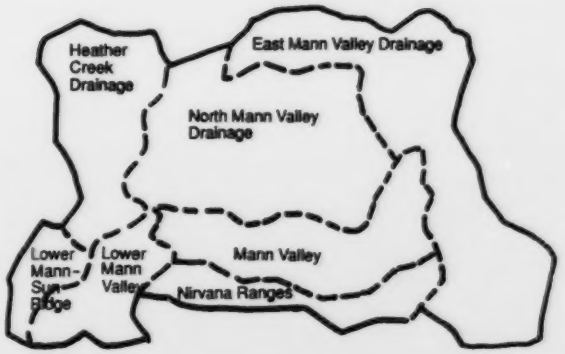


Figure C-8
Sample mapping of landscape units.

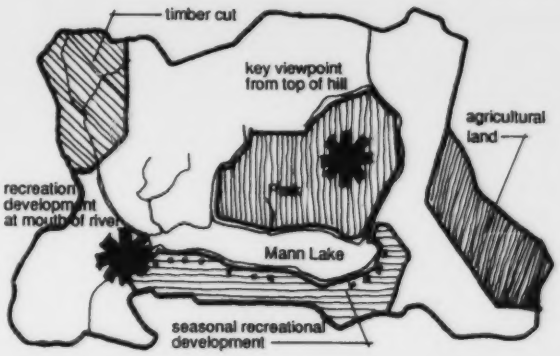


Figure C-9
Typical mapping of visible land use and cultural modifications.

Figure C-10
Aerial view of rural location showing various land use impacts and cultural modifications.

Methods for mapping landscape units include:

- Review other mapping units currently produced. Landscapes for B.C. Parks will be useful in identifing general landscape types. For mapping of smaller units undertake a process to map, first, the components of the visual landscape i.e. landform/topography, vegetation cover, water cover (density and pattern), and land use. Overlay these component maps, and identify areas of homogeneity.

- Field check boundaries of landscape units. A combination of low level flights and ground inspections should be made. Refine the boundaries accordingly.

- Document the character of each landscape unit, both in terms of the characteristics of its landform, vegetation, water cover and land use, but also by typical photographs. Use of video technology to record low level flights and field visit observations is to be encouraged.

- Map landscape units and subunits at a scale and on a base compatible with mapping by other disciplines working on the project.

- Recognize the data generated may have application to other projects, and co-ordinate data collection with the B.C. Ministry of Forests and B.C. Ministry of the Environment standards.

Figure C-11
Sample mapping of water cover.

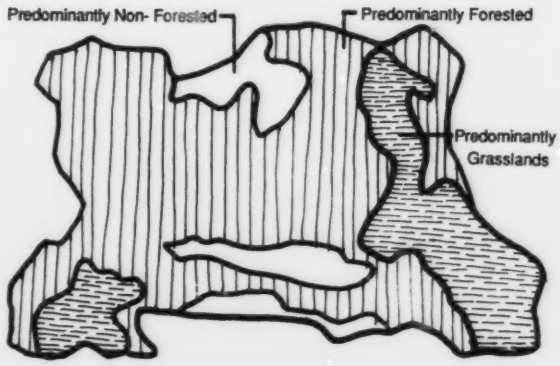


Figure C-12
Typical mapping of vegetation cover.

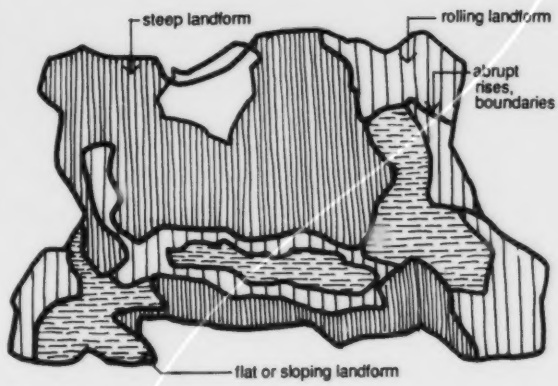


Figure C-13
Mapping of slope class and landforms.

3.0 Landmarks

Visual landmarks seen from the potential highway area will be mapped and considered during corridor and/or alignment selection.

Whereas landscape units represent **areas** of similar visual character, landmarks are **points** of visual interest. Landmarks may be attractive, or may detract from the surrounding landscape.

"**Attractor**" landmarks include:

- mountain peaks, ridges, or other distinctive landform.
- islands, points, or shoreline features.
- waterfalls or water features.
- ravines, hoodoos, coulees.
- distinctive vegetation or agricultural clearings.
- glaciers, snowcaps.
- man-made structures such as bridges, overpasses, religious centres, historic or architecturally significant buildings, settlements, partly exposed industrial complexes.
- designated points such as parks, recreation areas, viewpoints, and rest areas.

"**Detractor**" landmarks include:

- fully exposed open pit mines and quarries.
- forest clearcuts.
- fully exposed industrial complexes.
- junk yards.
- commercial businesses parking and yard operations.
- garbage dumps.

Figure C-14
Typical 'attractor' landmark.

Figure C-15
Typical 'detractor' landmark.

Design practices in response to landmarks should:

- Avoid highway alignments which obscure or come so close to attractor landmarks as to hinder their use and enjoyment. Avoid highway alignments which focus tangents or long curves on detractor landmarks.

- Manipulate highway alignments to focus tangents on attractor landmarks, for visual interest.

- Create landmarks in areas otherwise visually nondescript. Major highway structures such as bridges, overpasses, rest areas, etc. could all be attractor landmarks with careful design.

- Mitigate negative impacts on existing landmarks, by attention to detail highway alignment, vegetation or earthform buffers, or relocation/compensation for the landmark.

Methods for mapping of landmarks include:

- Field reconnaissance by the analyst is essential to identify landmarks. **Note: visual landmarks such as mountain peaks or islands may be well outside the study area used by other disciplines, but may still be very significant to the driver's experience of the highway.**

- Use of video technology for recording field observations on the ground and in low level flights would be useful.

- Solicit public input at meetings, to identify landmarks which might be known only to the local population, but which potentially could be quite significant.

- Map landmarks within the study area at the same scale as landscape units. Note that a map at a more broad scale may be required to identify significant landmarks outside the study area. Computer based mapping of these landmarks would be an asset, to allow easy transfer of scale when considering alignment alternatives and their relationship to distant landmarks.

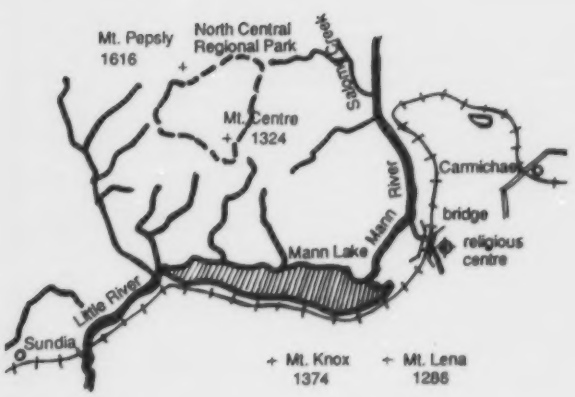


Figure C-16
Typical landmark map.

4.0 Views

Significant views affected by the proposed highway and potential viewpoints to be created by the highway will be mapped and evaluated during corridor and/or alignment selection. Views to be assessed include:

Map the view **toward** the road, from settlements or viewpoints in the surrounding landscape.

Views change depending on whether the road is being viewed from above or below and from what distance.

At preliminary planning stages, it is important for the planners to be aware of existing viewpoints, designated or otherwise, valued by the public. The future road could affect the views from:

- towns, villages, and rural residences
- tourist developments, including rest areas along existing roadways or proposed for the road being designed
- circulation routes - parks, trails, existing roadways, ferries, railways, or from other points along the road being designed
- recreational areas - ocean, lakes or rivers

Design practices in response to views **toward** the road should:

- Avoid traversing a significant viewshed. If the area must be crossed, look for a route which is least visible or of minimum detrimental affect. Generally, keep the alignment away from the viewpoint, in the background of the viewed area.
- Manipulate highway alignment to those landscape units with high visual absorption capability.
- Create a new, designated viewpoint, if the existing viewpoint will be made obsolete by the highway.
- Mitigate the effects of the highway on existing views by detailed alignment, buffer vegetation, plantings and earthform, and careful attention to colour and placement of retaining structures and revegetation.

Figure C-17
A highway directly in front of this viewpoint would create a major visual impact.

Figure C-18
Note how the cut slope on the distant slope is distracting.

Map the view **from** the road, which determines the driver's experience. Views from the road cannot be known in detail until the alignment of the road is chosen. However, at the preliminary planning stages, potential views or viewpoints which might be accessed by the highway should be mapped. These views might occur:

- from hillsides
- from valley rims and localized breaks in grade
- at mountain passes
- at shorelines
- at the edges of agricultural and forest clearings
- from the valley floor to landmarks on the valley wall or horizon.

Design practices which respond to these potential views should:

- Adjust an alignment to focus a tangent on a landmark or view.
- Adjust an alignment to a hillside bench or valley rim to provide a view of the landscape below.
- Provide pullouts, rest areas, or access by secondary road to existing and potential viewpoint areas.
- Route the highway to the edge of a clearing or shoreline picking the side with best view potential.
- Selectively clear existing vegetation to open a view or vista.
- Screen an unpleasant view.

Methods of designing views include:

- Video imagery can be used to record views in the field, taken from ground or low level flight reconnaissance. Computer software manipulates video images to superimpose changes.
- Public meetings will provide information about locally significant views.
- Computer software can create a map and perspective model of views seen from a given point.
- Map viewpoints and viewshed of existing and potential views at the same scale as Landscape Units.
- Record each major view by photograph and/or video. Use (50mm) camera lens for all photography, as wide angle or telephoto photography will distort the apparent significance of the view.

Figure C-19
Typical attractive view from the road.

Figure C-20
Designated viewpoints or pullouts can provide for pleasant and safe appreciation of a view offered by the road.

5.0 Visual Quality Assessment

Assessment of relative visual quality of landscape units will be performed during corridor and/or alignment selection.

Visual Quality is the overall impression retained after driving through, walking through or flying over an area of land.

Some landscape units possess a higher visual quality than others. With the visual quality of landscape units categorized and mapped as high, medium or low, highway engineers and consultants can assess the visual impacts of highway developments by comparing the relative visual quality within different landscape units through which proposed alignments pass.

Note that each individual region in the Province should be acknowledged to have unique scenic attributes. Consequently, for highway design purposes, it is the relative quality among landscape units within a region or watershed which is a primary concern.

Design practices in response to visual quality assessment should:

- Avoid areas of high visual quality.
  - Routing highways through areas of medium visual quality may provide an aesthetic experience with acceptable impacts. At the same time, secondary road access to areas of high visual quality will provide recreation access.
- Create visual interest in areas of low visual quality to enrich the driver's experience.
  - Provide scenic pullouts, viewpoints, rest areas and access to recreational opportunities. Major structures such as bridges and overpasses could be attractor landmarks when carefully designed.
- Screen or avoid unsightly areas.
- Mitigate impacts of highway development on high visual quality areas.
  - Reduce visual impacts in these areas by careful detailed alignment, retaining devices, and detailed vegetation management.

Methods for assessing visual quality include:

- Review the landscape units and subunits mapped earlier.
- Application of a reasoned and supportable rating system. This should be done by a professional Landscape Architect, or related discipline, with expertise in landscape aesthetics. A sample of a numerical rating system is illustrated in Table C-1. This numerical system is a format for a complex value judgement. Assessing the relative visual quality of different landscapes is by nature subjective. Designers should make an initial ranking of high, medium and low visual quality, then confirm and refine this judgement by comparison with the assessments of public representatives. The best visual quality ranking will be developed from consultations with people from different backgrounds.
- Summarize visual quality ratings on a map at the same scale as the landscape unit mapping.
- Record the process and reasoning which led to the visual quality ratings.

Criteria Governing Scenic Quality Rating Procedures

	Criteria For Determining Scenic Value Scale					
	High	Rating[1]	Moderate	Rating[1]	Low	Rating[1]
Landform	High vertical relief as expressed in prominent cliffs, spires or massive rock outcrops, or severe surface variation or highly eroded formations including major badlands or dune systems; or detail features dominant and exceptionally striking and intriguing such as glaciers.	3 to 5	Steep canyons, mesas, buttes; or interesting erosional patterns or variety in size and shape of landform; or detail features present and interesting though not dominant or exceptional.	1 to 3	Low, rolling hills, foothills or flat valley bottoms. Interesting detail landscape features few or lacking.	-2 to 1
Vegetation	A variety of vegetative types as expressed in interesting forms, textures, and patterns.	3 to 5	Some variety of vegetation, but only one or two major types.	1 to 3	Little or no variety or contrast in vegetation.	-2 to 1
Water	Clear and clean appearing, still or cascading white water, any of which are a dominant factor in the landscape.	3 to 5	Flowing, or still, but not dominant in the landscape.	1 to 3	Absent, or present, but not noticeable.	-2 to 1
Colour	Rich colour combinations, variety or vivid colour; or pleasing contrasts in the soil, rock, vegetation, water of snow fields.	3 to 5	Some intensity or variety in colours and contrast of the soil, rock and vegetation, but not a dominant scenic element.	1 to 3	Subtle colour variations, contrast or interest; generally mute tones.	-1 to 1
Adjacent Scenery	Adjacent scenery greatly enhances visual quality.	3 to 5	Adjacent scenery moderately enhances overall visual quality.	1 to 3	Adjacent scenery has little or no influence on overall visual quality.	-2 to 1
Scarcity	One of a kind; or usually memorable, or very rare within a region. Consistent chance for exceptional wildlife or wildflower viewing, etc.	3 to 5	Distinctive, though somewhat similar to others within the region.	1 to 3	Interesting within its setting, but fairly common within the region.	-2 to 1
Cultural Modifications	Free from aesthetically undesirable or discordant sights and influences; or modifications add favorably to visual variety.	3 to 5	Scenic quality is somewhat depreciated by inharmonious intrusions, but not so extensive that the scenic qualities are entirely negated or modifications add little or no visual variety to the area.	1 to 2	Modifications are so extensive that scenic qualities are for the most part nullified or substantially reduced.	-3 to 1

[1] Composite Quality Rating Scores
A = 21 to 35 points
B = 8 to 20 points
C = -14 to 7 points

Note re timing : Rate for scenic quality under the most critical conditions, i.e. under highest seasonal use.

Table C-1
Scenic Quality rating criteria.
(After Yeomans, 1983, and USDI Bureau of Land Management, 1980.)

6.0 Visual Absorption Capability

Assessment of visual absorption capability for the landscape units will be completed during corridor and/or alignment selection.

Visual Absorption Capability is defined as the capacity of the landscape to screen proposed development and still retain its inherent character.

The relative Visual Absorption Capability of each landscape unit can be assessed in order to identify those units which could accept highway construction with the least visual change to the landscape. **The higher the Visual Absorption Capability the less visual change will be caused by highway construction.**

Factors which influence Visual Absorption Capability (VAC) include:

slope - the steeper the slope, the lower the VAC

soil stability and erosion potential - the more erosion or sliding potential, the lower the VAC

vegetation regeneration potential - the lower potential for regeneration e.g. talus slopes or desert, the lower the VAC

vegetation diversity - the more vegetation diversity, the greater the VAC

potential soil and vegetation colour contrast - the greater the contrast, the lower the VAC

Each unit or subunit should be given a Visual Absorption Capability rating of High, Medium or Low.

Planning actions in response to the Visual Absorption Capability ratings should:

- Avoid areas with low VAC ratings. A highway is likely to create a significant scar on these landscapes. A route through medium or high VAC areas will have low visual impacts.
- Mitigate visual impacts when passing through low VAC areas. Design practices in response to visual absorption capacity might include:
  - modification of alignment and cross section to avoid steep slopes.
  - reduction of steepness of side slopes.
  - reduction of area of side slopes by retaining devices.
  - feathering edges of clearings.
  - matching revegetation and rock cut colour to adjacent natural condition.

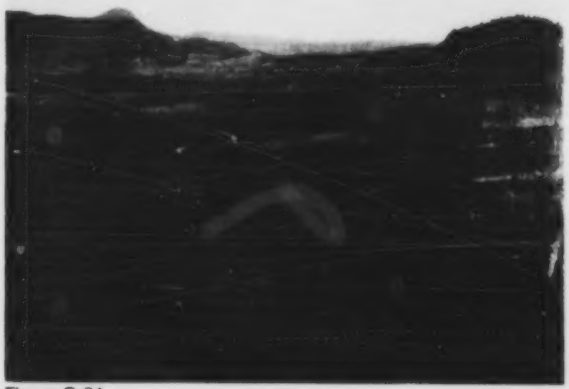


Figure C-21
In this scene, the valley has a moderate VAC, but VAC is low in the surrounding foothills.

Figure C-22
This subalpine lake and surroundings are low in VAC, primarily because of steep slopes and low vegetation regeneration.

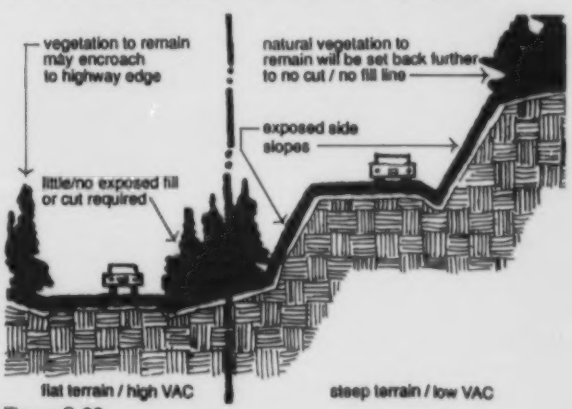

vegetation to remain may encroach to highway edge
natural vegetation to remain will be set back further to no cut / no fill line
exposed side slopes
little/no exposed fill or cut required
flat terrain / high VAC
steep terrain / low VAC

Figure C-23
The steeper the slope, the lower the VAC.

Methods of assigning Visual Absorption Capability ratings include:

- Review landscape units and subunits and identify: degree of slope, soil stability and erosion potential, vegetation regeneration potential, vegetation diversity, and potential soil and vegetation colour contrast.

- Mapping additional landscape subunits if necessary to identify areas which possess homogeneous qualities. Because factors such as vegetation diversity or vegetation/soil colour contrast may be quite localized, the VAC ratings may lead to generation of additional landscape subunits.

- Assigning a VAC rating for each subunit. A formula for use as a guide is VAC = S x (E+R+D+C), where:
  - **S = Slope** - the steeper the slope, the lower the VAC in percent
  - **E = Soil stability and erosion potential** - positive factors raise VAC: negative factors lower VAC
  - **R = Regeneration potential** - the greater the potential, the higher the VAC
  - **D = Vegetation diversity** - the greater the diversity the higher VAC
  - **C = Soil and vegetation colour contrast** - the lower the contrast the higher VAC

  High VAC = 29-36 points
  Moderate VAC = 20 - 28 points
  Low VAC = 4-19 points.

- Map VAC ratings in High, Medium and Low categories on maps at the same scale as landscape units.

- Record the assessment process.

FACTOR	CHARACTERISTICS	VAC VALUES VERBAL	NUMERICAL
(S) Slope	Steep: 60%+	Low	1 (multiplier)
	Moderately Steep: 30-60%	Mod	2 (multiplier)
	Relatively Flat: 0-30%	High	3 (multiplier)
(E) Soil stability and erosion potential	High constraint value derived from high erosion hazard and/or high instability hazard	Low	1
	Moderate constraint value derived from erosion hazard and/or instability hazard	Mod	2
	Low constraint value as above	High	3
(R) Vegetation Regeneration Potential	Low regeneration	Low	1
	Moderate regeneration	Mod	2
	High regeneration	High	3
(D) Vegetation diversity	Non-vegetated, grasslands or brush cover	Low	1
	Coniferous, deciduous, cultivated	Mod	2
	Diversified (mixed open and woodlands)	High	3
(C) Potential soil and vegetation colour contrast	High visual contrast between exposed soil and adjacent vegetation	Low	1
	Moderate visual contrast between exposed soil and adjacent vegetation (and all bare, cultivate and diversified vegetation types)	Mod	2
	Low visual contrast between exposed soil and adjacent vegetation	High	3

Table C-2
Relative importance of VAC factors,(adapted from Blau, et al., 1979)

7.0 Visual Interest: The Driver's Experience

Preliminary corridor assessment and alignment selection will include an evaluation of the visual interest provided for the driver, with a view to avoiding lengths of highway which are both monotonous and unsafe.

Visual analysis techniques for many linear developments are similar. People travelling on highways will react to the aesthetics of the surroundings. This section deals with the view from the road by the driver - the driver's experience.

Engineers, landscape architects, and consultants must step back and imagine the experience of the driver when evaluating alignment alternatives, or detail design of highway components. Will the driver's experience be pleasant, varied and interesting?

Monotony creates unsafe drivers. It is therefore in the interest of safety, as well as aesthetics, that a varied and interesting driving experience be developed. An alert driver is more likely to be a safe driver.

As a general rule highway engineers, and designers, should provide a renewed reason for driver interest at least once every 5 to 10 minutes. These 'points of interest' should be staged to maintain the driver's attention to the surroundings, the road and its navigation. The spacing between points of interest may vary, but should always be sufficiently frequent to avoid boredom and weariness.

Table C-3 outlines an idealized driving experience. Engineers and designers should review alternative alignments, determine if there are areas of potential monotony in the routes, and assess what modifications to the alignment or design could be made to relieve the potential monotony.

Time : Distance Relationship

	Distance Required for View	
	Fleeting (0.5sec)	Panoramic (5.0sec)
Design Speed	minimum	minimum
50 km/hr	6.90 m	69.0 m
60 km/hr	8.25 m	82.5 m
70 km/hr	9.70 m	97.0 m
80 km/hr	11.20 m	112.0 m
90 km/hr	12.50 m	125.0 m
100 km/hr	13.80 m	138.0 m

Table C-3

Driver's Experience Staging Plan

Duration (minutes)		**Point of Interest**
Actual	**Average**	
3	5	highway entrance/orientation
10	5	curvilinear alignment
2	5	views to landmarks - mtn. peaks
5	5	tangent - passing opportunity
1 to 5	5	viewpoint pullout
2	5	tangent - scenery changes
10	5	curvilinear alignment
8	5	split level median introduced
3	5	tangent focusing on landmark
1 to 7	5	rest area/viewpoint/scale
10	5	curvilinear alignment
5	5	access to commercial services
—	—	destination or repeat above

60 TO 70 MINUTES TOTAL TIME depending on stops
Note that the distance between points of interest will vary with design speed, see Table C-4.

Table C-4

Time : Distance Relationship

Time: 5 minutes

Design Speed	**Distance**
50 km/hr	4.16 km
60 km/hr	5.00 km
70 km/hr	5.83 km
80 km/hr	6.67 km
90 km/hr	7.50 km
100 km/hr	8.33 km
110 km/hr	9.16 km

Table C-5

Figure C-24
Experience 1: curvilinear alignment, varying vegetation setbacks, rounded slopes

Figure C-25
Experience 2: split median, split grade, median vegetation.

Figure C-26
Experience 3: one way curvilinear alignment.

Figure C-27
Experience 4: tangent, focus on landmark.

Figure C-28
Experience 5: viewpoint/information area.

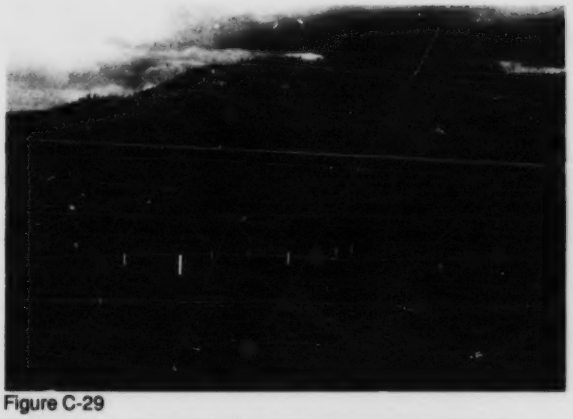


Figure C-29
Experience 6: curvilinear alignment, more open countryside.

Methods of stimulating driver interest could include:

- Varying the alignment style of the road between tangential and curvilinear alignments.
- Changing the cross section of the road, by adding a median, or by creating a split level section.
- Accessing views from the road. These may be appreciated while driving the road, or may be accessed by pullouts or rest areas. This requires careful alignment decisions, and selective vegetation removal.
- Focusing tangents on natural and created landmarks.
- Providing interpretive signage and related rest areas.
- Providing direct access to roadside trails, bikeways, parks, and picnic areas
- Providing roadside rest areas and tourist information centres.
- Providing access to commercial facilities - villages, service stations, tourist attractions and accommodations.
- Careful design of bridges, tunnels and overpasses, and means to stop to appreciate these structures.
- Aligning the road to move into a different landscape unit, thereby creating a change in scenery.
- Manipulating roadside vegetation and planting to create interest - leaving stands of trees in the median, feathering the edges of clearings, or installing accent plantings
- Accent lighting for bridges, tunnel portals, roadside waterfalls.

Methods for Assessing Visual Interest include:

- Review of potential corridor or alignment alternatives.
- Identification of points of interest along each alternative.
- Measuring the distance and determining the time interval at the design speed between such points.
- Identification of sections where the time interval will exceed 5 minutes.
- Assess what refinements or additions could be made to reduce the time interval in those sections.
- Suggestion of other alignment changes or additions which could improve the driver's experience.
- Ranking which alternatives are best in terms of driver's experience.
- Documenting recommendations and mapping points of interest at same scale as alignment alternatives.

8.0 Integration of Guidelines into Highway Design

Visual Resource Management considerations will be integrated into the highway design process in parallel with other considerations, from the time of project identification through to completion of construction.

Visual resource management is only one factor among many to be addressed in highway design. Successful design must balance factors such as highway function, economics, political and cultural jurisdictions, fisheries and wildlife, forestry, and recreation as well as aesthetics. Aesthetic considerations cannot be adequately addressed **after** a highway is designed, but must be incorporated throughout the design process.

Visual Opportunities and Constraints

To allow fair value judgments to be made, it is necessary for visual factors to be presented in a map form which is parallel with that of other factors. It is also necessary to identify at what points in the design process visual factors are best considered.

To allow integration with other disciplines, critical visual factors should be summarized in a Visual Opportunities and Constraints Map. This map should highlight those visual factors which would be of most significance to highway designers. These factors might include:

- areas of high visual quality and low visual absorption capability.
- dramatic edges of landscape units.
- attractor landmarks, and potential tangents which would focus on them.
- attractor landmarks which will accommodate recreational use and their access points.
- detractor landmarks, and extent of visual influence.
- significant existing viewsheds, and potential viewpoints.
- significant vegetation changes or clearings, either natural or manmade.

In general, the opportunities and constraints map should summarize those elements which the visual resource analysts suggest are important to the alignment and design of the highway. In complex cases, for purposes of clarity, it may be necessary to create a separate map for constraints, and a separate map for opportunities.

These maps should be to the same scale as the maps being used for highway planning purposes. The opportunities and constraints maps should be supported by explanatory text, cross referenced to the supporting detailed maps and documents created in previous visual resource management steps outlined herein.

Visual Impact Simulation

Issues may arise during the course of design which would benefit from simulation of visual impacts or opportunities. Computer programs exist to create images which represent fairly the appearance of an alternative. Programs are able to plot a seen area and create a perspective image of major earthworks or clearing activities.

Combining video cameras and software allows a video image to be digitized, and then to have a second video or drawn image superimposed. This creates video images of proposed changes, and is very useful for visualizing the impact or benefits of alternatives from specific viewpoints.

Simulation as described above should be used when resolution of a specific issue is sought.

Aesthetic Design Process

Aesthetic factors should be incorporated into highway design from the inception of a project to its construction completion. The following provides a checklist for incorporating aesthetic considerations into a typical highway design process.

At Project Identification and prior to corridor selection:

- Review the general scenic quality of the landscape to be traversed.
- Assess the type of users who will predominate on the highway - tourist, recreational, commercial, or commuter.
- Assess the destinations along the highway- urban, suburban, rural, resort area, through traffic.
- Determine the Aesthetic classification of the highway or portion of the highway:
  - Baseline Highway
  - Tourway
  - Parkway

During Corridor Assessment:

- Perform a visual resource inventory, including:
  - landscape units and subunits.
  - landmarks.
  - views and viewsheds.
- Complete visual resource assessments, including:
  - visual quality assessment.
  - visual absorption capability assessment.
- Summarize visual opportunities and constraints.
- Incorporate visual factors in corridor alternatives.
- Review the visual impacts of corridor alternatives, and recommend a preferred corridor.
- Assess selected corridor, and suggest means to improve corridor boundary.
- Identify mitigating measures necessary.
- Record anticipated visual impacts of the selected corridor, and in particular ensure that directives for future planning and mitigating measures are documented and highlighted to planners at more detailed scales.

During Alignment Selection:

- Review, update and complete visual resource data base from corridor assessment. If no such data base was generated, develop one.
- Transfer visual resource data to the alignment planning scale.
- Summarize visual opportunities and constraints relevant to alignment selection.
- Incorporate visual factors in identification of alignment alternatives.
- Review the visual impacts of alignment alternatives, and recommend a preferred alignment.
- Assess selected alignment, and suggest means to improve alignment in particular concerning visual interest and driver's experience. Locate and perform preliminary design for rest areas, pullouts, and other roadside facilities.
- Identify mitigating measures necessary. Provide cost estimate of required mitigating measures, and ensure that associated budgets are allocated.
- Record anticipated visual impacts of the selected alignment, and in particular ensure that directives for future design and mitigating measures are documented and highlighted to planners and designers at detailed scales.

During Detail Design:

- Provide direction on detail design and implementation of mitigating measures.
- Monitor detail design of alignment, cross section and typical details. Consider refinements which accommodate recommended guidelines.
- Provide leadership in aesthetics of: detail design of roadside facilities, roadside clearing and grubbing, earthworks, structures, revegetation, and roadside facilities.
- Produce cost estimates of roadside development and mitigating measures. Ensure appropriate budgets are allocated, and complete working drawings and specifications.
- Ensure that aesthetic mitigating measures required as a result of one discipline's design solutions are addressed in working drawings and specifications of other appropriate disciplines.

During Construction:

- Provide field review services during clearing and grubbing, to ensure that required buffer areas remain and are protected, and that vegetation management as prescribed is performed.
- Identify minor modifications to site grading for slope rounding, rock outcrop treatment, or tree belts.
- Supervise finished grading and revegetation in the field.

After Construction:

- Develop maintenance procedures which support and develop the aesthetic intents developed in the previous stages.
- Provide the required resources to adequately maintain this visual resource.

Note: Document project successes and failures for the future information of other Ministry personnel and consultants.

Alignment

Alignment

Introduction

Pleasant and graceful highways rely heavily on well designed roadway alignments. Alignment is one of the most complex aspects of highway design involving the elegant resolution of numerous and often contradictory pressures.

Successful alignment requires the integration of horizontal and vertical curvature to create a fluid, comfortable and safe driving experience.

Alignment choices must respond to the adjacent topography, acknowledging significant landmarks and respecting the presence of fragile valleys and shorelines. Alignments which minimize their impact on the surrounding landscape will reduce visible scars, as well as construction and maintenance costs.

For the driver a well designed highway alignment will result in a pleasant, visually stimulating, and safe driving experience. Varied medians should be considered, and when developed in response to landform or other considerations should make sense from behind the steering wheel, as comfortable responses to topography and vegetation.

Alignment can have a dramatic influence on the driver's experience by revealing views toward waterbodies or valleys, at the same time withholding views toward negative features such as forestry clearcuts and cleared utility corridors.

The following section outlines specific recommendations which when considered together will direct the evolution of highway alignment toward this goal of ingeniously simple and beautiful solutions.

Recommended Practices

The following pages outline recommended practices concerning the aesthetic alignment of highways in B.C. These practices are summarized below.

1.0 Design roadway alignments as one integrated and co-coordinated blend of vertical alignment and horizontal alignment, with consideration to the inclusion and variable width of the median.

2.0 Respond to the topography of the site.

3.0 Increase the level of interest of the driver and therefore the driver's attentiveness, safety and enjoyment.

4.0 Minimize confusing and erratic changes in alignment.

5.0 Provide safe decision and stopping sight distances to maintain the aesthetic experience of the driver.

6.0 Evaluate existing and potential views from the road to its surroundings and to the road itself.

7.0 Retain existing vegetation wherever feasible to mitigate an alignment's impact and therefore enhance the driver's experience.

8.0 Minimize the aesthetic consequences of adverse climatic conditions.

9.0 Consider potential aesthetic responses to negative ecological impacts attributed to road alignment.

10.0 Consider responses to aesthetic impacts directly attributed to land use changes caused by road alignment.

1.0 Integration of Alignment

Design roadway alignments as one integrated and co-coordinated blend of vertical alignment, and horizontal alignment, with consideration as to the inclusion and variable width of the median.

.1 Integrate the alignment of horizontal and vertical curves.

- Align vertical and horizontal curves with co-incident midpoints.
- Maintain similar approximate length in horizontal and vertical curves.
- Where vertical and horizontal curves coincide the horizontal curve should lead.

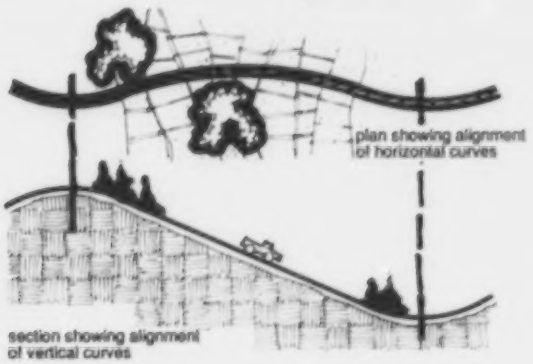


Figure D-1
Align vertical and horizontal curves with co-incident midpoints.

Figure D-2
Where vertical and horizontal curves do not coincide the vertical curves should lead.

.2 Where changes in direction are appropriate, design horizontal and vertical alignments as a series of long arcs with limited or no connecting tangents.

.3 On divided highways use independent vertical and horizontal alignments where advantageous.

**refer to EARTHWORKS and VEGETATIVE MANAGEMENT for implications of alignment adjustments and screening of views.*

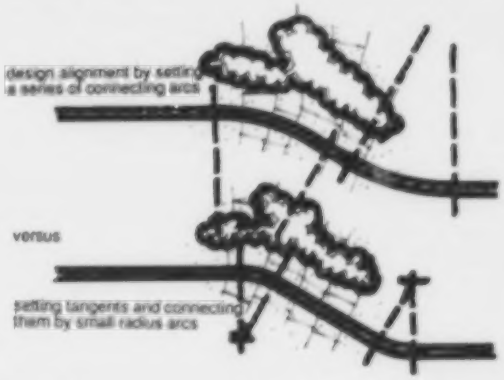

design alignment by setting a series of connecting arcs
versus
setting tangents and connecting them by small radius arcs

Figure D-3
Arc and spiral highway design.

Figure D-4
Consider separate alignments for divided highways

2.0 Response to Topography

Design the length of curves, tangents and changes in response to existing topography, landmarks, vegetation, and land use patterns. The response to topography requires different practices for different terrain as illustrated for the following special conditions.

.1 Flat Terrain

- On flat terrain (less than 5% slope), make long tangents predominate. Where strong land use pattern exists, align tangents with, and change direction in response to pattern.
- Where strong land use pattern is **not** present, focus alignment on natural or created landmarks such as mountain peaks, hills, water bodies, islands, significant tree specimens, shelterbelts, or buildings.
- Change direction in response to natural features. Withhold change of direction in response to large topographic features until within 5.0 km. Withhold change in direction in response to landmark trees and buildings until within 1.5 km.
- Change alignment or direction to skirt marsh, fen, kame and kettle, bog agricultural and forest clearings.

Figure D-5
Align tangents with land use and vegetation grid.

Figure D-6
Tangents should focus on natural or man-made landmarks.

Figure D-7
Ideal angle and distance from landmark.

Figure D-8
Skirt the edge of clearings and sensitive areas.

.2 Steep Terrain

- Align road along the contact between scree slopes and vertical rock face.
- Shape rock cuts and blasted areas to simulate adjacent landscape character.
- Earthworks at the skyline should reflect surrounding topography.
- Use separate terraced alignments and fill slopes to reduce cut and fill requirements to facilitate revegetation.
- Minimize the visual impact of traversing hillsides by running along the contour and responding to vegetation patterns.
- Ascend hills with minimum visibility from adjacent areas.*
- When traversing hillsides consider bridging gullies to reduce visible fill slope scars.

** refer to EARTHWORK and ROADWAY STRUCTURES (Retaining Wall).*

Figure D-9
Align roadway at the margin between scree slopes and vertical rock face.

Figure D-10
Terraced cut slopes allow for subsequent revegetation.

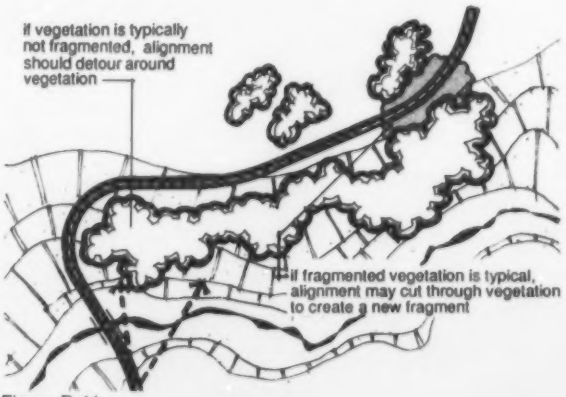

if vegetation is typically not fragmented, alignment should detour around vegetation
if fragmented vegetation is typical, alignment may cut through vegetation to create a new fragment

Figure D-11
Respond to vegetation patterns while traversing hillsides.

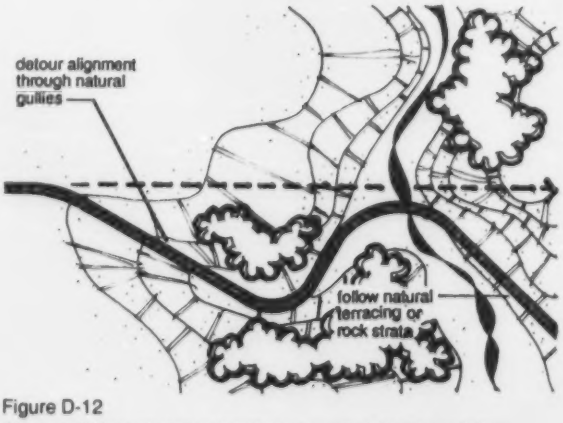


Figure D-12
Align road through natural gullies or created breaks to follow natural terracing or linear rock strata.

.3 Oceans, Lakes and Reservoirs

- Minimize the requirement for realignment, and regrading to natural shoreline.*
- Take advantage of potential views from road and roadside facilities.
- Provide mitigating measures when encroachment at water bodies is unavoidable.

*refer to EARTHWORKS and ROADWAY STRUCTURES (Retaining Walls)

Figure D-13
The view to adjacent water bodies can substantially enhance the driving experience.

Figure D-14
Views from the roadway can be accommodated without impacting the shoreline.

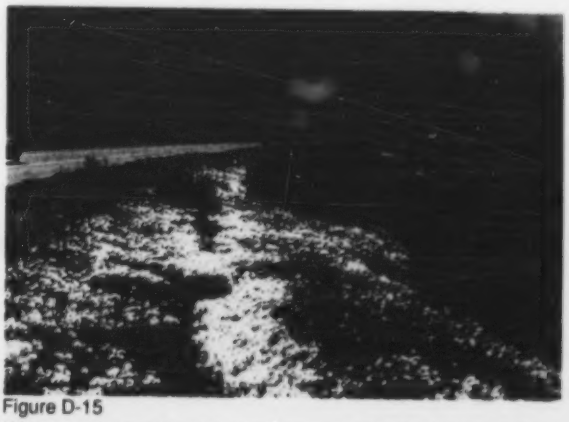


Figure D-15
Where roadway alignments do impact on waterbodies aesthetics of shoreline treatment should be given a high priority.

.4 Rivers and Streams

- Minimize the requirement for channelization, realignment and regrading of natural banks to reduce the impact on natural watercourses and limit the possibility of subsequent erosion.*
- Minimize the amounts of highway runoff flowing directly into natural watercourses.
- Do not allow the right-of-way clearing to visually dominate the natural open space dimensions along the watercourse.
- Provide an advance view of bridges, then withhold view until bridge.**
- Design bridges as an extension of the horizontal and vertical curvature of adjacent sections of the roadway.
- Design bridges to be visually interesting and in context with the surrounding landscape character.

refer to EARTHWORKS and HIGHWAY STRUCTURES (Retaining Walls)

**refer to ROADWAY STRUCTURES (Bridges and Overpasses), EARTHWORKS and VEGETATIVE MANAGEMENT for integration with topography and vegetation.*

Figure D-16
Do not encroach on water bodies closer than 7.5 metres. This roadway would be better with a vegetated buffer between it and the river.

Figure D-17
In this example care has been taken to preserve the vegetated edge adjacent to the lake.

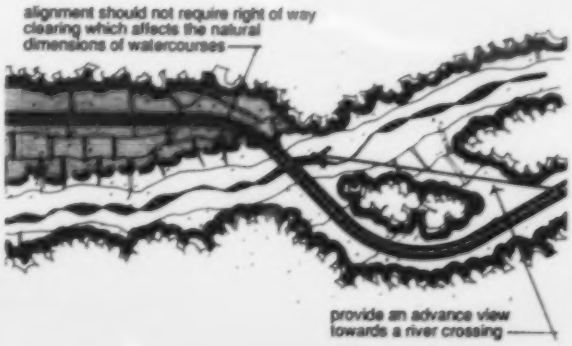

alignment should not require right of way clearing which affects the natural dimensions of watercourses
provide an advance view towards a river crossing

Figure D-18
Roadway alignment should not require clearing which overwhelms the natural dimensions of waterbodies.

Figure D-19
Bridges should become an extension of the curvilinear alignment of adjacent roadways.

.5 Valleys and Ravines

- Make a transitional descent into valleys and ravines.
- Make perceivable response in horizontal and vertical alignment to valley, gully, or swale.
- Make bridges and their approaches a continuation of the adjacent alignment.

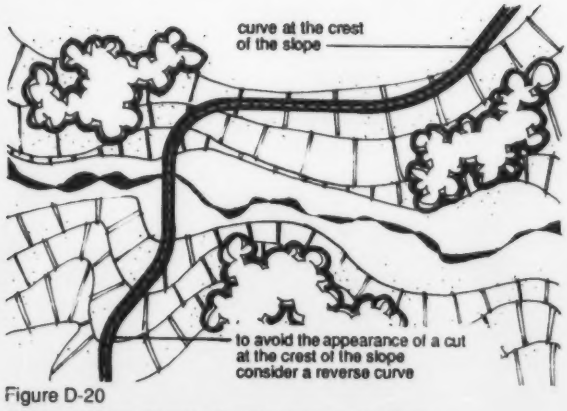


Figure D-20
Align road through natural gullies or created breaks.

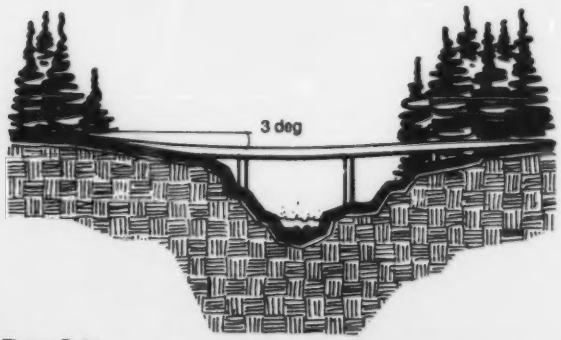


Figure D-21
Angle the vertical approach into the valley at a minimum of 3 degrees, to show a perceivable response to the valley.

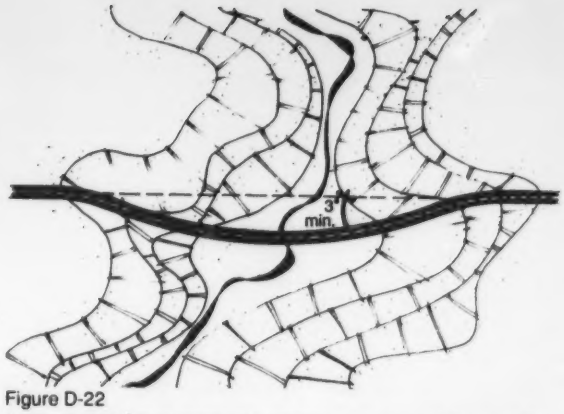


Figure D-22
Angle the horizontal approach into the valley at a minimum of 3 degrees, to expose views away from the road to the valley length and walls.

Figure D-23
Bridges should be designed as part of the horizontal and vertical alignment of the adjacent road. This straight bridge interrupts an otherwise graceful curvilinear alignment.

3.0 Driver Interest and Experience

Increase the level of interest of the driver and therefore the driver's attentiveness, safety and enjoyment.

.1 Align the highway to offer a variety of views, points of reference and surroundings to maintain the interest and attentiveness of the driver.*

- Locate some form of roadside facility to enable a driver to leave vehicle once every 1 hour driving time at the design speed.
- Provide a reason for renewed visual interest approximately every 5 minutes in the driver's experience.
- Consider inclusion of, or variation in, width of median.

*refer to VISUAL RESOURCE MANAGEMENT for additional detail on Driver's Experience.

Figure D-24
Focus on landmarks such as mountains, predominant hills, landmark trees, forests, shelterbelts, and/or landmark buildings.

Figure D-25
Cross the edges of landscape units as this highway does passing from a forested area in the foreground, to an open grassland, and back into the forest in the distance.

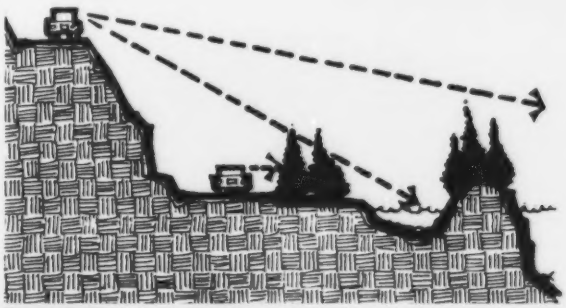


Figure D-26
Alternate between a sense of enclosure and long distance views (eg. forest vs. agricultural clearings, or tree groupings within a predominantly open landscape.)

Figure D-27
A varied median width can be used to enhance the driver's interest and attentiveness.

4.0 Confusing Alignment

Minimize confusing and erratic changes in alignment.

.1 Make horizontal alignment straightforward and responsive to context.

- Change direction in response to visual features, so as to avoid the appearance of sudden unexpected turns.
- Provide an intermediate transitional curve from tangents to horizontal curves.
- Co-ordinate vertical and horizontal curves to best display the road ahead to the driver.
- Limit the view of the road ahead within the area of effective vision to no more than three changes in alignment.

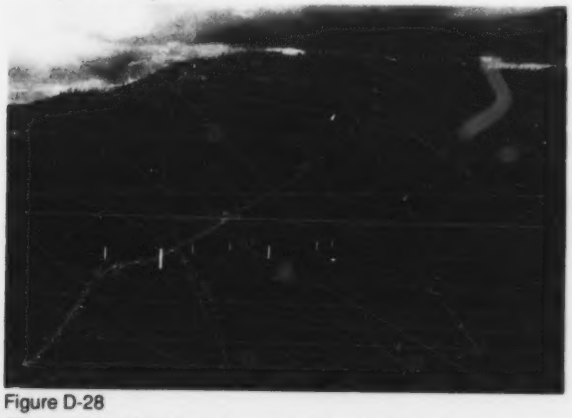


Figure D-28
Alignment should change in response to significant visual features

Figure D-29
Limit the view of the road ahead within the area of effective vision to no more than three changes in alignment.

.2 The design of vertical alignments can contribute to a readily comprehensible roadway.

- Avoid a repetitious sequence of vertical curves giving the impression of a roller coaster.
- Avoid sharp sags in the road which may obscure the view of oncoming traffic for brief periods.
- Design vertical curves at lengths approximating the limits of effective vision.

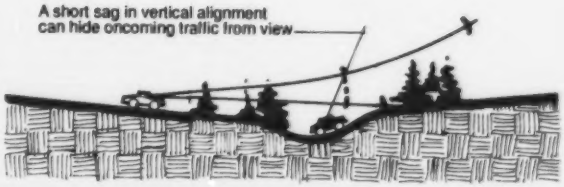


Figure D-30
Avoid short vertical curves which may obscure the view to oncoming traffic.

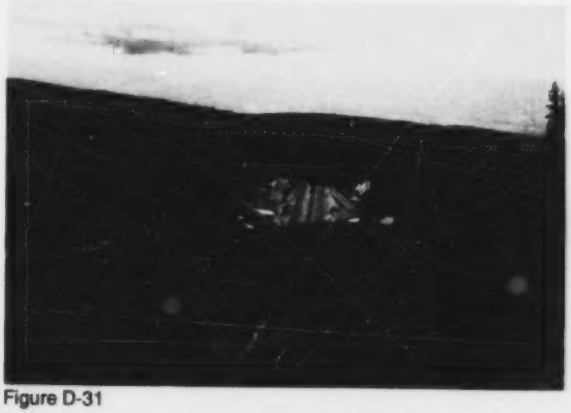


Figure D-31
In this photograph signs have been erected to warn motorists of restricted visibilty as a result of a short vertical curvature.

Figure D-32
Avoid a sequence of grade changes which may appear as a roller coaster.

Figure D-33
Vertical (sag) curve should approximate horizontal curve length.

Figure D-34
Vertical curve length should approximate length of effective vision.

.4 Eliminate confusing relationships between alignments and between highway and frontage roads.

- Provide a visual screen of earthwork or vegetation.
- Screen and lengthen horizontal curves where alignments converge.
- Avoid deceptive clearings from appearing at the end of tangents.

Figure D-35
Provide a visual screen between frontage roads and highways.

Figure D-36
Align roads to avoid clearings at the ends of tangents.

5.0 Safety

Provide for safe sight distances, adequate protection against headlight glare, and safety recovery areas to minimize stress to the driver.

.1 Pay attention to safe sight distances to access/egress points, safety signage, and passing zones.

- Provide safe decision sight distances at approaches to interchanges.
- Provide safe decision sight distances at passing zones.
- Provide safe decision and stopping sight distances at approaches to intersections.
- Provide safe decision and stopping sight distances at approaches to roadside facilities.
- Provide safe decision and stopping sight distances at signage.

Minimum stopping sight distance

design speed km/h	design values for minimum stopping sight distance m
40	45
50	65
60	85
70	110
80	140
90	170
100	200
110	220
120	240
130	260

Figure D-37
Indicates minimum stopping sight distances at various design speeds. (Taken from RTAC)

Note: For additional information refer to the Roads and Transportation Association of Canada's (RTAC) Manual of Geometric Design Standards for Canadian Roads, and Province of British Columbia's Highway Design Manual of Standards and Instructions for existing or revised safe sight distance.

.2 Alignment should include space to allow traffic leaving the highway to stop safely.

- Roadway cross sections should allow for a safety recovery zone with a gradual slope adjacent to traffic lanes.
- Cross sections should also include medians with shrub planting to safely slow the progress of traffic leaving the highway.

Figure D-38
The grassed safety recovery area at the edge of this roadway is provided to allow vehicles to make emergency stops. Typically these areas will not have slopes exceeding 5:1.

Figure D-39
Shrubs used for median planting can provide an additional measure of crash protection.

.3 Provide adequate protection against the glare of oncoming headlights.

- For divided highways minimize the occurrence of convergent alignments.
- Where convergent alignments cause headlights to shine into the path of oncoming traffic the impact can be minimized by any, or a combination of the following:
  - a bermed median.
  - ambient/background lighting.
  - vegetative screen with maximum density between 0.3m and 1.3m height.
  - a light diffusing fence.

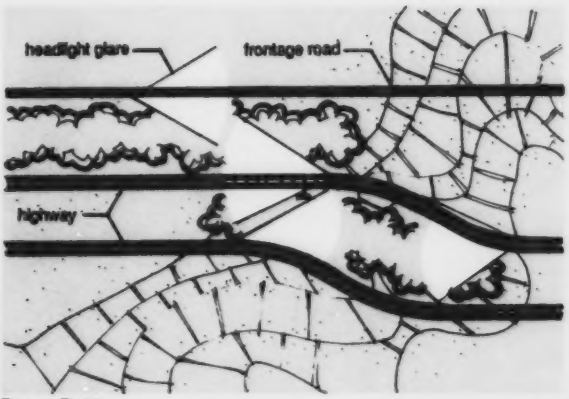


Figure D-40
For divided highways avoid convergent alignments where headlights will shine into the path of oncoming traffic.

Figure D-41
In this photograph, vegetation within the median minimizes the impact of headlight glare from oncoming traffic.

Figure D-42
A raised berm between opposing directions of traffic will also limit the impact of headlight glare.

6.0 Response to Views

Evaluate existing and potential views from the road to its surroundings and to the road itself.

.1 Consider that the "Area of Effective Vision" will have a significant impact on the driver's awareness of the roadside context.

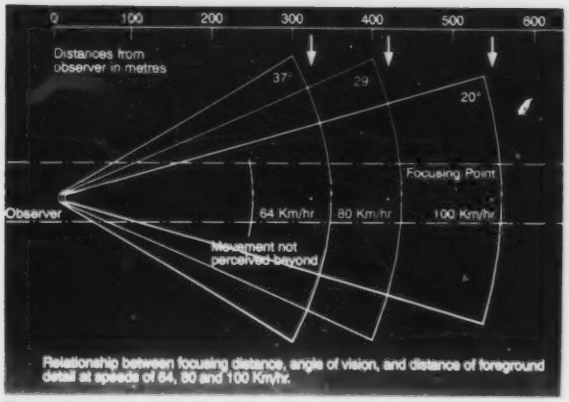


Figure D-43
The 'Area of Effective Vision' is expressed diagrammatically indicating a diminishing visual impact with increasing distance and greater angles away from the direction of travel.

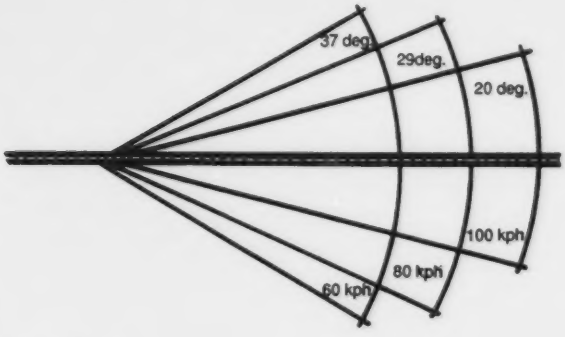


Figure D-44
The area of effective vision will become longer and more directional with increased design speeds.

.2 Minimize the view to utility corridors .

- Screen underground energy utility corridors from the road.*

refer to CLEARING AND GRUBBING for integration with existing vegetation

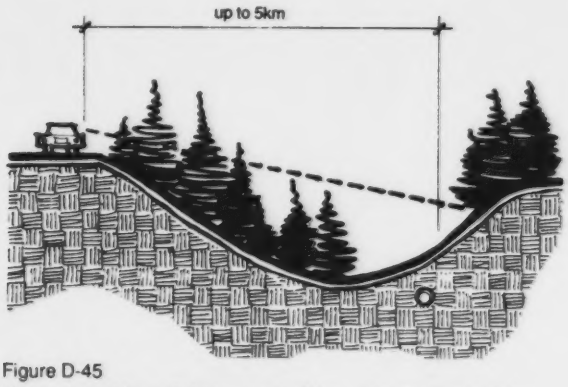


Figure D-45
When viewed from distances up to 5 km., where utility corridors cut through forest, screen the groundplane of the cleared right of way with vegetation and earthworks.

Figure D-46
Make revegetation of the utility corridor where it intersects the road a priority.

.3 Minimize the visual impact of high voltage powerlines.*

*refer to CLEARING AND GRUBBING for feathering and revegetation techniques

Figure D-49
Do not align the road to focus on a powerline corridor at the end of a tangent.

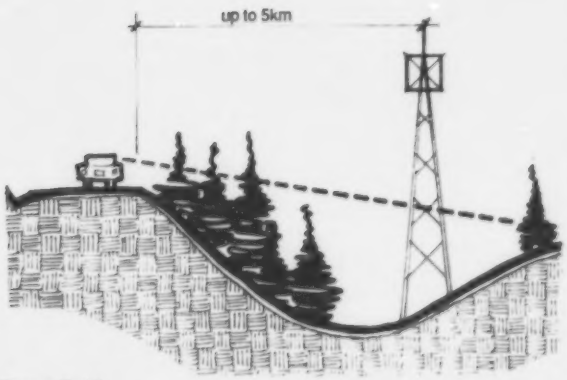


Figure D-47
Viewed from a distance of up to 5 km., where corridors cut through forests, screen the groundplane of the cleared right of way.

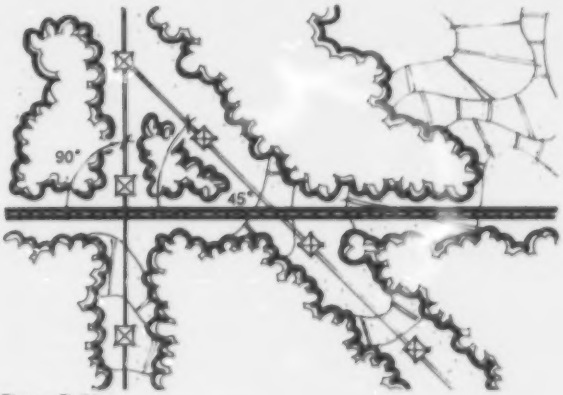


Figure D-50
Intersect the powerline with the road at the perpendicular or at an angle no less than 30 degrees.

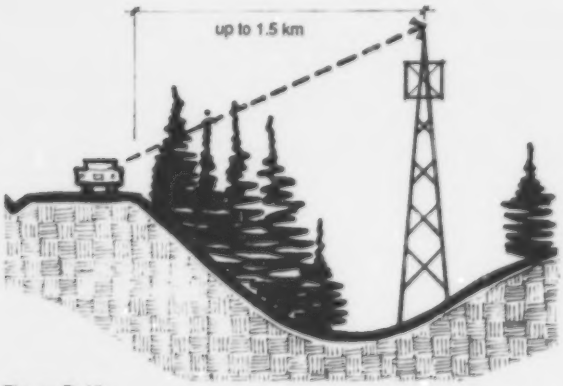


Figure D-48
In treed areas, viewed from distances up to 1.5 km., screen the powerline support structure.

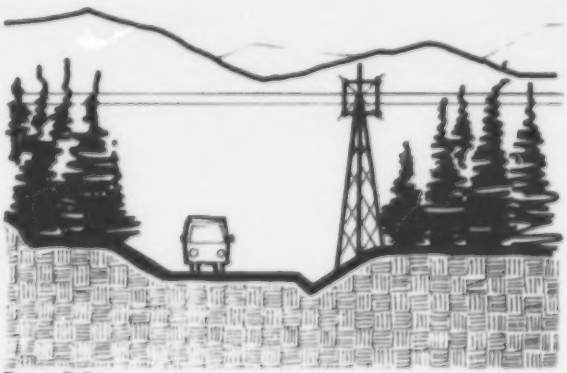


Figure D-51
In hilly or mountainous terrain, route the highway so that, from a distance of 0-1.5 km., the powerline, where it intersects the road, will not appear above the horizon line (eg. descending into a local low point with middleground backdrop).

.4 Minimize the impact of existing timber cuts and anticipate future timber cuts.*

- Develop alignments which reduce the negative visual impact in areas where existing timber cuts cannot be completely concealed.
- Provide a visual screen where clearcuts can be seen from the highway.
- Where future cutting is anticipated the visual integrity of the roadway should be protected through provision of buffers within the right of way, or by land use control, or by scenic easement controls in cooperation with the Ministry of Forestry.

*refer to EARTHWORKS and CLEARING AND GRUBBING for integration with adjacent site conditions

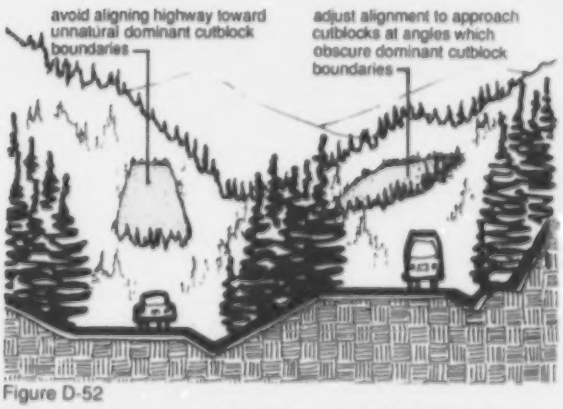

avoid aligning highway toward unnatural dominant cutblock boundaries
adjust alignment to approach cutblocks at angles which obscure dominant cutblock boundaries

Figure D-52
Where cut has occurred within 3 years and when viewed from a distance of 5-8 km, avoid alignments which focus the road on dominant lines of the cut.

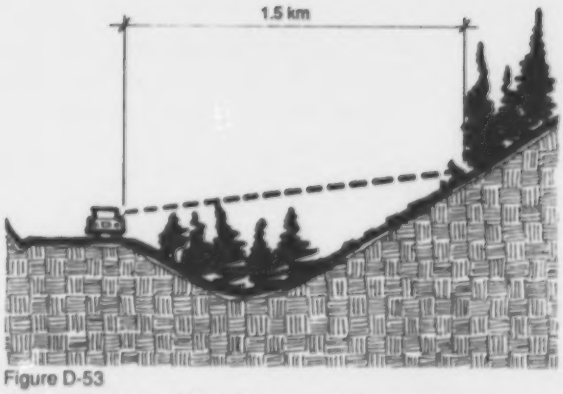


Figure D-53
When viewed from within 1.5 km., screen the area of the cut in its entirety.

Figure D-54
Additional space is required to construct an adequate visual screen which could have concealed this timber cut.

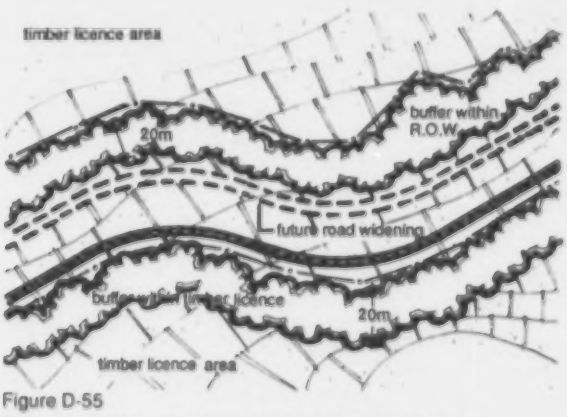


Figure D-55
Set aside a 20 m wide visual screen within the right of way, exclusive of future road widening and clearing requirements, OR require a 20 m wide perpetually forested screen within the adjacent allocated timber license area.

.5 Minimize views to unsightly uses such as garbage dumps, junkyards, manufacturing, and industrial or commercial parking areas and yard operations.

- Align tangent of road away from unsightly commercial uses, so that such uses are not evident within the area of effective vision.
- Provide pleasant views away from direction of unsightly use to divert driver's attention.*
- Avoid or screen view of ground plane of unsightly commercial business operations viewed from a distance of within 1.5km.**

refer to VISUAL RESOURCE ANALYSIS and CLEARING AND GRUBBING and VEGETATION MANAGEMENT for identification of potential views and integration with adjacent site conditions

**refer to EARTHWORKS and VEGETATION MANAGEMENT for integration to adjacent site conditions*

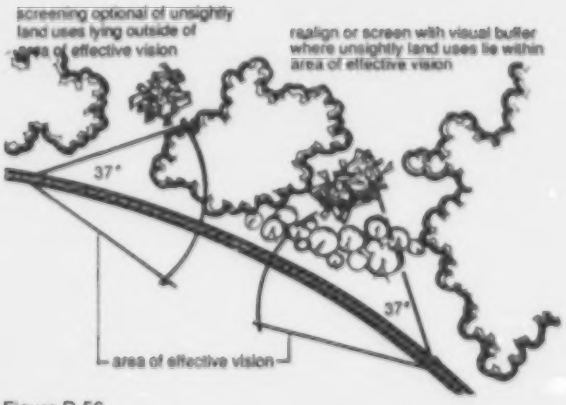

screening optional of unsightly land uses lying outside of area of effective vision
realign or screen with visual buffer where unsightly land uses lie within area of effective vision
37°
37°
area of effective vision

Figure D-56
Align tangents away from those commercial uses which are unsightly. For business operations immediately adjacent to the road, provide room for a minimum 20 m wide vegetative buffer. Buffer may take the form of an earthwork berm if appropriate to local terrain.

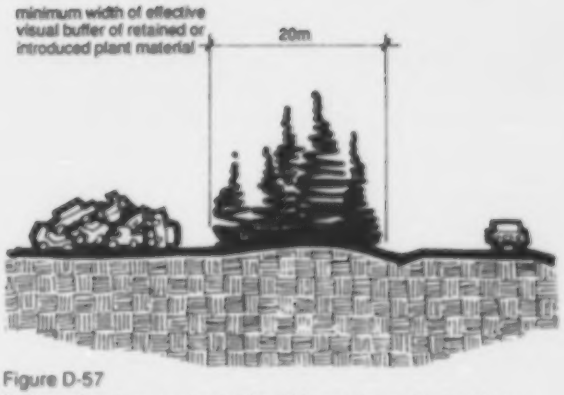


Figure D-57
Buffers of native vegetation should be minimum 20m width in rural areas.

Figure D-58
Alignment does not allow sufficient room to screen these commercial billboards on private property. More signs are being erected in cleared areas to the right of the photograph. There is not sufficient right-of-way to establish a buffer zone.

.6 Recognize and enhance potential views.

- Adjust alignment to gain view.
- Align road so that view can be accommodated from roadside facility.*
- Provide alignment which will expose views in manner appropriate to a moving vehicle.
- Adjust alignment to provide a variety of views, avoiding the monotony of a constant 'good' view.**

Figure D-61
Skirt open spaces which provide views (eg. agricultural or forest clearings or open spaces associated with water such as rivers, streams, oceans, lakes, reservoirs, marshes, bogs).

Figure D-59
Some planting has been undertaken to screen this hydro installation. A more continuous planted buffer would have been more successful.

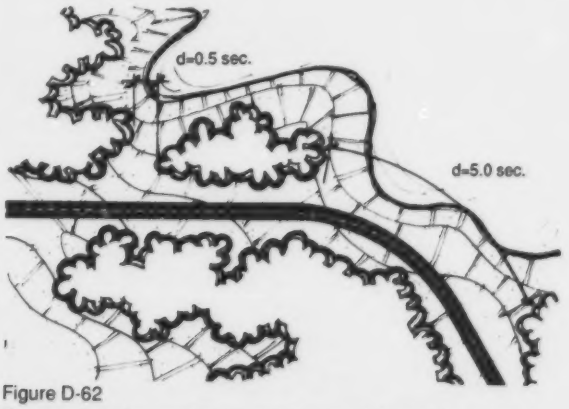


Figure D-62
Expose views for a minimum of 0.5 seconds for fleeting views, 5.0 seconds for panoramic views.

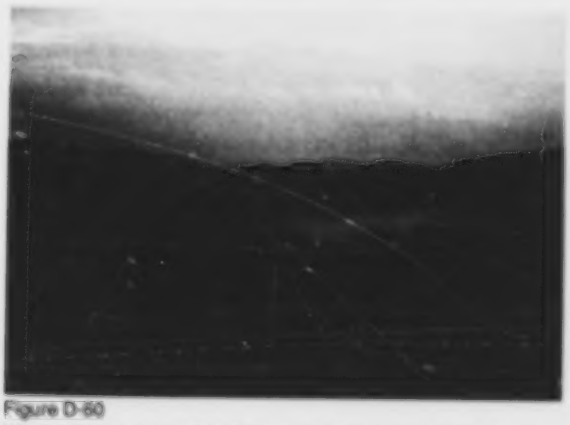


Figure D-60
Where highways are aligned on upper slopes recognize the opportunity to create spectacular viewpoints.

refer to ROADSIDE FACILITIES for space, and accessibility requirements

refer to VISUAL RESOURCE ANALYSIS for identification of potential views

**refer to CLEARING AND GRUBBING and REVEGETATION for integration with adjacent vegetative conditions*

**refer to ROADSIDE FIXTURES and ABOVE GROUND UTILITIES to ensure enhancement of views*

**refer to VISUAL RESOURCE ANALYSIS for analysis of potential views*

7.0 Response to Vegetation

Retain existing vegetation to mitigate an alignment's impact and therefore enhance the driver's experience.

.1 Respect existing natural vegetation patterns.

- Align road along natural plant community edges.
- Align road at edge of natural clearings of forests.*
- Road alignments through homogeneous plant communities will require special attention to keep drivers alert and attentive.**

Figure D-63
Retain natural elements which provide a break from the view for a minimum of 0.5 seconds, at irregular intervals (5 minutes apart).

Figure D-64
Align road along forest edges. Forested conditions require alignment to respond to changes in vegetation type and density.

.2 Respect existing man-made vegetative patterns

- Align roads parallel with shelterbelts, hedges.
- Align tangents toward landmark trees.

**refer to CLEARING AND GRUBBING, and REVEGETATION for creating natural forest edges*

***refer to EARTHWORKS, CLEARING AND GRUBBING and VEGETATION MANAGEMENT for integration with adjacent site conditions*

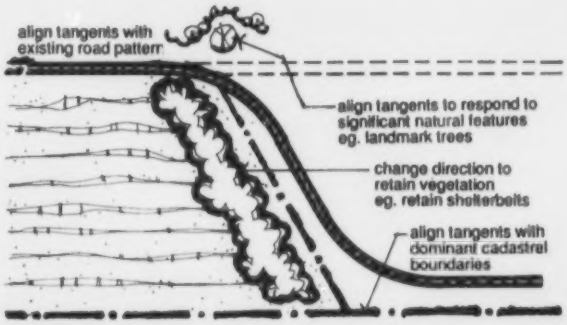

align tangents with existing road pattern
align tangents to respond to significant natural features eg. landmark trees
change direction to retain vegetation eg. retain shelterbelts
align tangents with dominant cadastral boundaries

Figure D-65
Align roads parallel to hedgerows and make tangents focus on significant landmark trees.

Figure D-66
This maple retained within the median contributes to the overall quality of the highway and to the driver's experience.

8.0 Secondary Aesthetic Impacts - Climate

Actions undertaken to mitigate the impact of adverse climatic conditions should consider potential aesthetic consequences.

.1 Align road to minimize potential icing conditions in high risk areas.

.2 Align road to minimize effects in high risk snowdrift conditions.

- Set alignment back a distance of 7 to 8 times the height of a moderate (50%) vegetative screen (preferred).
- Set alignment back a distance of 11 to 12 times the height of a light (25%) vegetative screen.
- Set alignment back a distance of 13 to 14 times the height of a dense (75%) vegetative screen.

.3 Minimize the occurrence of sun glare.

- Avoid alignments running directly east or west into a rising or setting sun.
- Feather vegetative edges to reduce abrupt transitions from full shade to full sun.

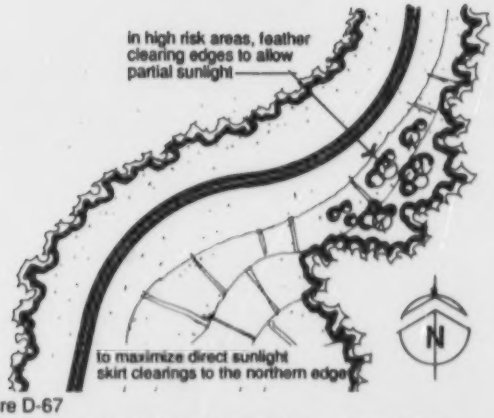

in high risk areas, feather clearing edges to allow partial sunlight
to maximize direct sunlight skirt clearings to the northern edge
N

Figure D-67
Expose road surface to direct sunlight from east and south directions by alignments skirting clearings, providing for feathering of vegetation on south and east, and decreasing amount of cut zones.

Figure D-68
Where aesthetics warrant vegetation close to the pavement, review early morning sun angles to minimize icing. Adjust alignment and/or vegetation to reduce problems as identified.

9.0 Secondary Aesthetic Impacts - Ecosystems

Consider potential aesthetic responses to negative ecological impacts attributed to road alignment.

.1 Consider the implications of changes to waterflow patterns.

- Avoid obstruction of drainage patterns with fill.*
- Anticipate channelling and avoid subsequent erosion.**

Figure D-69
In this photograph an ecologically well resolved culvert outflow needs additional care to create an aesthetically satisfactory solution.

.2 Consider the implication of grade changes to the continuity of wildlife habitat.

Figure D-70
Roadway alignment should recognize and skirt sensitive habitat areas.

*refer to VISUAL RESOURCE ANALYSIS for identification of potential alignment constraints

*refer to EARTHWORKS, CLEARING AND GRUBBING and REVEGETATION for integration with adjacent site conditions

*refer to ROADWAY STRUCTURES (Retaining Walls) for consideration of walls in lieu of earthworks

**refer to ROADWAY STRUCTURES (Bridges and Overpasses) for consideration of alternatives to fill

10.0 Secondary Aesthetic Impacts - Adjacent Land Use

Consider responses to aesthetic impacts directly attributed to land use changes caused by road alignment.

.1 Avoid unproductive divisions of land that encourage abandonment or leases to uses deemed unsightly (eg. billboards).

- Align to property boundaries.
- Incorporate unproductive units of land into right-of-way.
- Provide access to isolated sections of land. Such access might be separate from the controlled access highway if necessary.

.2 Minimize impact of temporary facilities related to road construction.

- Site borrow pits within median or right of way wherever feasible.
- Where not feasible to keep temporary facilities (eg. borrow pits) within alignment, allow for a retained or future vegetative screen of 20m width and/or rehabilitative earthwork of a height necessary to screen the groundplane of the site.
- Intersect access road with the primary road right-of-way at a 90 degree angle. The tangent of the access road at the intersection should be no longer than 15m with the curve leading into this tangent of no less than 15 degrees.
- Where locations permit, quarries and construction camp sites should be chosen for potential development as roadside facilities.

**refer to EARTHWORKS and VEGETATION MANAGEMENT for integration with adjacent site conditions*

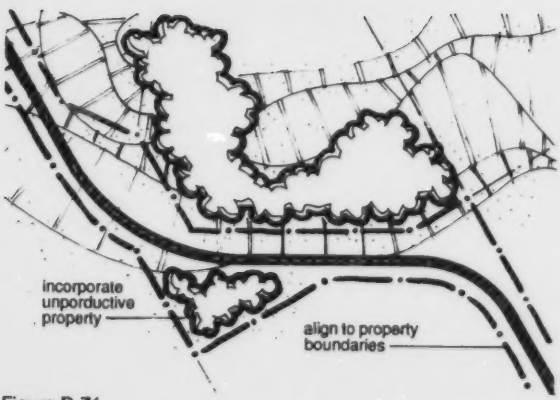


Figure D-71
Alignment should follow property boundaries where possible. Small, isolated parcels should be purchased for right of way.

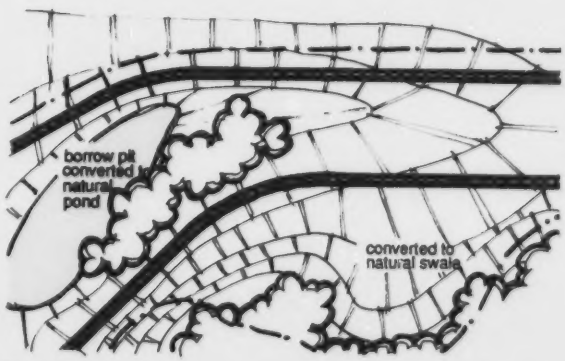


Figure D-72
Borrow pits can be integrated into earthwork design within the right of way.

Clearing and Grubbing - Vegetation Management

Clearing and Grubbing - Vegetation Management

Introduction

Natural vegetation within the right of way is bought and paid for. It is the most economical long term landscape material. Clearing and grubbing, if over-zealously carried out, or if done without knowledge of the ultimate design and aesthetics of the highway, can create major costs for revegetation and subsequent maintenance.

Clearing and grubbing is the first step in highway construction. Adequate control of clearing and grubbing requires that the objectives of aesthetics and vegetation management are identified and incorporated into the clearing and grubbing plans.

Well managed clearing and grubbing operations can play a major role in meeting the following objectives:

- screening **from the road** of unsightly conditions.
- reducing the visibility **from adjacent areas** of the road.
- reducing problems associated with headlight glare, sun glare, and snow and ice accumulation.
- creating visual interest along the highway.
- framing and focusing views.
- blending the highway into the adjacent natural landscape.

Recommended Practices

The following pages outline recommended practices concerning the aesthetics of clearing and grubbing for highways in B.C., as summarized below:

1.0 Before clearing commences, decide location, method and access routes to slash disposal areas.

2.0 Determine the method of clearing in response to the required scale and level of detail of clearing.

3.0 Undertake clearing in stages and allow for field adjustments to the clearing line.

4.0 Selective clearing shall be guided by highway safety requirements, utility and underground services and aesthetics.

5.0 Clearing and grubbing of roadside facility areas must be carried out with attention to detail, warranted by close on-site inspection.

Note: Construction will not be considered complete until: all debris has been disposed of, revegetation of the site is complete, and erosion control has been accomplished.

1.0 Location of Disposal Areas

Before clearing commences, decide location, method and access roads to slash disposal areas.

.1 Burn all slash whenever possible, and bury only burnpile residue.

.2 Integrate slash residue disposal location with highways design and construction phasing.

- Locate slash residue in areas requiring non-structural fill during construction.
  - areas of non-structural fill
  - uphill lee sites
  - depressions within median
- Locate slash residue in areas requiring rehabilitation after highway construction.
  - borrow and waste pits
  - temporary construction camps
  - provide a vegetation screen of minimum 20 m wide exclusive of all possible future clearing.*
- Do not use natural depressions outside of the median or water bodies for disposal of slash.

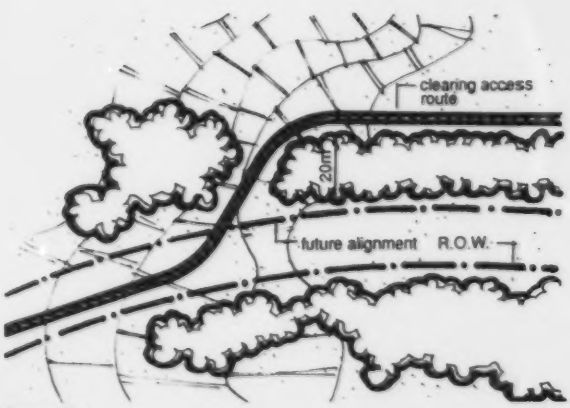


Figure E-1
Where clearing access routes cannot be contained within the right of way, separate the route from the highway by a 20 m buffer.

.3 Limit clearing access roads to within required clearance areas wherever feasible.

- Where not feasible, separate clearing roads by a 20m wide vegetative screen.
- Intersect access road with the primary road right of way at a 90 degree angle. The tangent of the access road at the intersection should be no longer than 15m, with the curve leading into this tangent of no less than 15 degrees.
- Revegetate routes not required for use after construction.**

refer to EARTHWORKS (Site Preparation) for co-ordination of sites

***refer to REVEGETATION for revegetation*

2.0 Method of Clearing

Determine the method of clearing in response to the required scale and level of detail of clearing.

.1 Pay attention to direction of falling.

- fell toward centre of area to be cleared/away from selectively cleared or retained plants
- fell away from water bodies

.2 Specify method of clearing:

Manual and /or Horse, for:

- selective clearing for views, or selective thinning of roadside vegetation.
- selective clearing of dead, dying and wind susceptible trees
- areas with difficult accessibility
- environmentally sensitive areas
- rest area walkways
- roads with 1m limited clearing from pavement edge within roadside facilities and along pit /haul access roads.

Helicopter, for:

- areas with difficult accessibility
- environmentally sensitive areas

Vehicle, for:

- large scale clearance
- road with limited 1m clearing from the pavement edge which cannot be cleared by manual and/or horse due to scale, economics, and unavailability of other means.

.3 Bury or dispose of off-site all non-combustible debris remaining after burning.

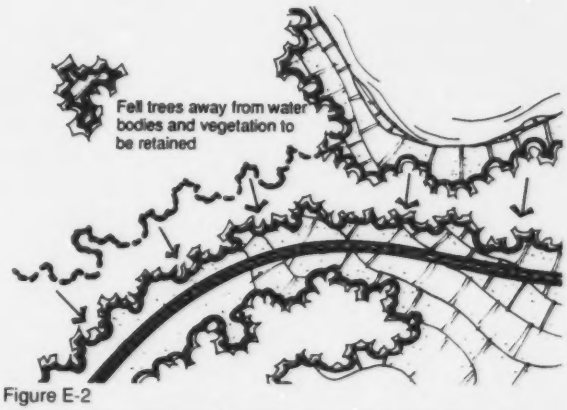


Figure E-2
During felling operations be careful not to disturb fragile areas.

3.0 Limits of Clearing

Allow for field adjustments to the clearing line, by clearing in stages as below:

.1 First, clear control line of alignment.

- for control line survey.
- for cross-section surveys.

.2 Second, clear so as to retain existing vegetation in the outer 10% of the distance between control line and the limit of clearing line.

- stake the no-cut/no-fill line and make minor field adjustments.
- assess specimen vegetation, rock outcrops, water bodies and natural banks to be retained.
- consider salvage of selected plant specimens in areas not to be retained, for potting, storage and revegetation at construction completion.*
- assess plant material requiring removal for design speed setbacks.**
- reassess proposed limit of clearing line, prior to removal of vegetation to the no-cut/no-fill line.***

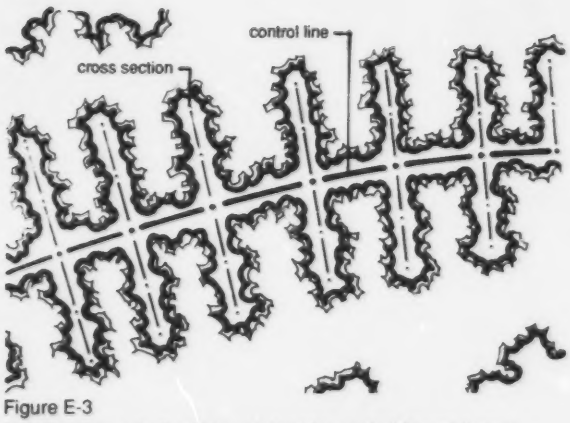


Figure E-3
Initially, clear only the lines required for control line and cross section survey.

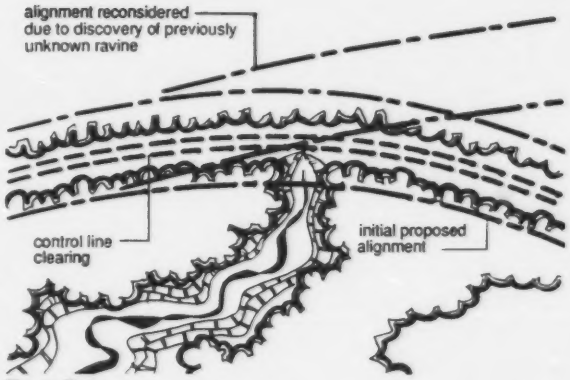

alignment reconsidered due to discovery of previously unknown ravine
control line clearing
initial proposed alignment

Figure E-4
Refine alignment to avoid special topography or features revealed during control line survey, prior to mass site clearing.

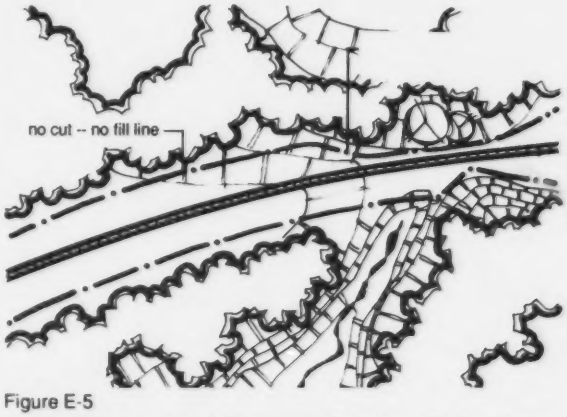


Figure E-5
Inspect the outer 10% of the proposed clearing to find landscape features which might be saved by minor readjustment to proposed grading.

*refer to CLEARING AND GRUBBING for plant storage and planting techniques.

**refer to CLEARING AND GRUBBING (Selective Clearing) for setback requirements

**refer to CLEARING AND GRUBBING (Roadside Facilities), and ROADSIDE FACILITIES for details of clearing for all functions of facilities

***refer to EARTHWORKS, REVEGETATION, and ROADWAY STRUCTURES (Retaining Walls) for implications of slope design and retention

.3 Mark vegetation to be selectively cleared to the proposed clearing line.

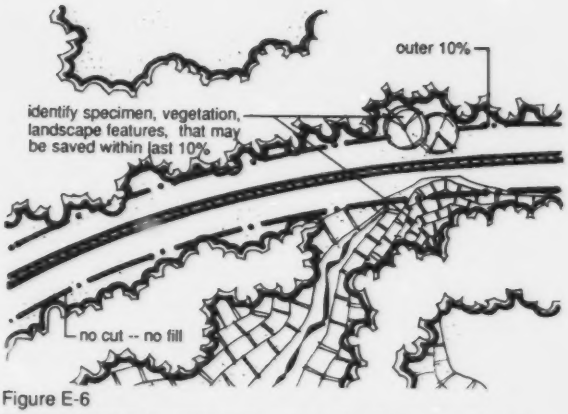


Figure E-6
Prior to clearing the outer 10%, assess visual screen and noise abatement requirements.*

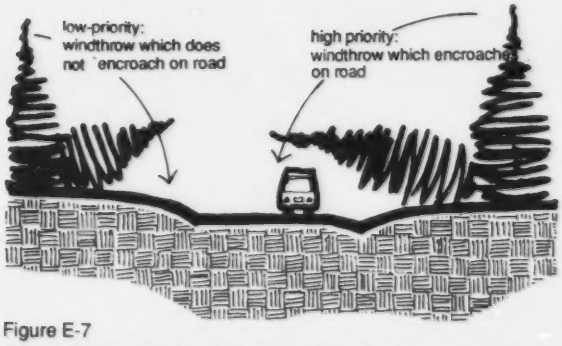


Figure E-7
Assess dead, dying and wind susceptible plantings, removing only those which pose a threat to the area within paving edge, future above ground utility lines, sight lines and sight triangles.**

.4 Clear within remainder of right-of-way and/or within scenic easement outside right-of-way only those areas deemed necessary and so marked in the field.***

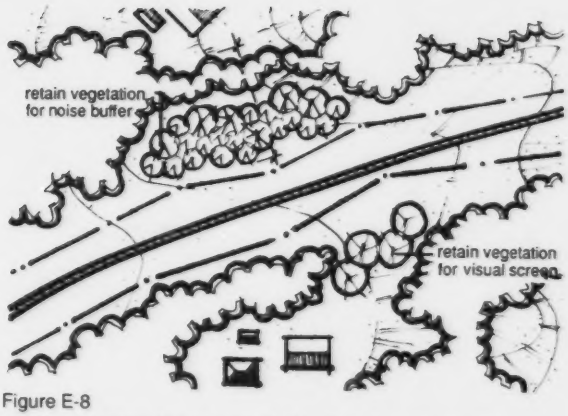


Figure E-8
Finished clearing should respect objectives for visual, and environmental factors, in addition to engineering requirements.

refer to ALIGNMENT (Secondary Aesthetic Impacts) for widths

**refer to CLEARING AND GRUBBING (Selective Clearing) and REVEGETATION for details*

***refer to CLEARING AND GRUBBING (Roadside Facilities) and ROADSIDE FACILITIES for separate clearing and grubbing policies and practices*

4.0 Selective Clearing

Selective clearing will be guided by highway design safety requirements, utility and underground services, and aesthetics.

.1 Respect operational highway design safety requirements.

- Provide design speed setbacks to trees with diameter larger than 100mm.

90km/h or greater	=	10m from pavement edge
80-90 km/h	=	7m from pavement edge
60 - 80km/h	=	6m from pavement edge
60km/h or less	=	2m from pavement edge

- Relaxation of the above setback distances can and should be taken where concrete traffic barriers or equivalent are used.

.2 Use clearing techniques to reinforce highway design speed.

- Emphasize the need to slow down at off-ramps and "reduce speed" zones by leaving vegetation closer to the roadway as design speed reduces.

- Retain shrubs, saplings, and trees with diameters less than 100mm adjacent to deceleration zones to provide added visual stimulus for deceleration. Exact setback distances in these cases should be determined by field judgments in response to vegetation species and desired speed reduction.

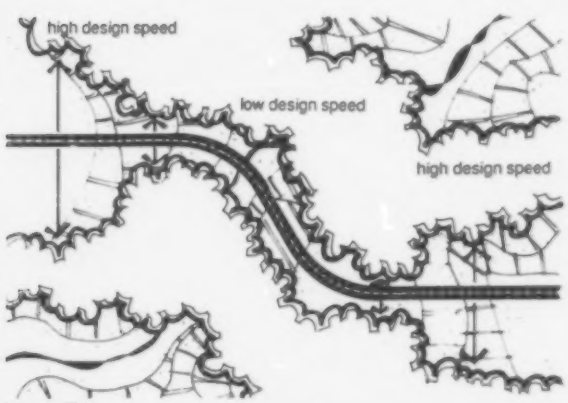


Figure E-9
Vegetation closer to the highway can help slow down traffic where the design speed is reduced.

.3 Where clearing is only for sight distance requirements, leave vegetation whose mature height will not exceed 600mm above the finished elevation of the highway pavement.

Figure E-10
Retain vegetation whose mature height will not exceed 600mm above the finished elevation of the highway.

Figure E-11
Selective clearing should be guided by highway safety requirements and aesthetic considerations.

.4 Provide setbacks to treeline for special conditions as follows:

passing - distance to allow minimum passing sight distance at design speed

signs - minimum horizontal distance setback of 2m or as necessary not to obscure reading of sign

intersections - distance required to respond and react

driveways and access roads - minimum horizontal distance of 2m

rail crossings (uncontrolled) - distance, measured from the crossing, of the minimum stopping distance for the highway design speed and distance, measured from the crossing, as travelled by the train equivalent to the interval required for the vehicle to stop. Must comply with Railway Act requirements for sight distance.

- Where tree branches extend over the roadway remove lower limbs to a vertical height of 5m above the travelled portion of the road.

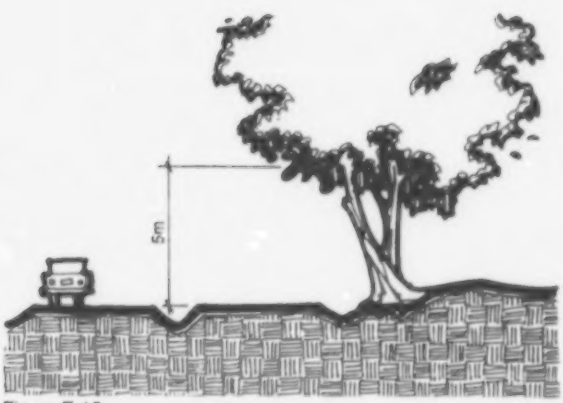


Figure E-12
Clear lower limbs of overhanging trees to 5m clear height.

- Retain strips of native vegetation to minimize headlight glare between opposing directions of traffic, and between the highway and frontage roads where medians of 20m width or more exist, and where conditions allow. Inclusion of trees within these areas may be subject to safety restrictions.
  - retain vegetation within median, outside no-cut/no-fill line, whose mature height exceeds 1.5m minimum above the finished elevation of the highway pavement (1.8m minimum where truck traffic is prevalent).
  - retained vegetation should be 2m minimum width for shrubs, 10m minimum width for trees. Supplement with vegetation under revegetation management where minimum width can not be retained.
  - retain plant material in median at end of tangents where two alignments converge
- When clearing is undertaken to minimize the impact of adverse climatic conditions care must be taken to incorporate aesthetic design practices.

**refer to EARTHWORKS, and CLEARING AND GRUBBING.*

Figure E-13
Native vegetation retained within the median can help reduce the impact of oncoming headlights

.5 Clear present and future locations of utility and underground services.

- Clear trees which at maturity will exceed trunk diameters of 100mm to setbacks as below:

luminaire standards	6.0m
utility poles	3.0m
underground services	1.5m
catchbasins	2.0m
manholes	1.5m
valve boxes	1.5m
fire hydrants	3.0m

- In utility alignments retain native vegetation wherever it does not obstruct drainage, conflict with service lines, or impede emergency services.

Figure E-14
Note how utility lines are concealed by Arbutus trees retained at the roadway edge.

.6 Avoid disturbance of water bodies.

- Retain vegetation as required to preserve the ecological integrity of fish bearing water bodies.
- Retain vegetation adjacent to all other year-round water courses.
- Meet all applicable environmental standards.
- Ensure that tree felling does not affect water-bodies or vegetation adjacent to waterbodies.

Figure E-15
Retain vegetation along the shores of waterbodies.

*refer to VEGETATION MANAGEMENT for maintenance of clearance

**refer to EARTHWORKS for integration with adjacent site conditions

.7 Reflect natural vegetation habitat.

- Undulate the forest edge.
  - vary clearing from the minimum width approximately 15m into the tree stand.
  - avoid straight dominant cut lines.
  - do not vary clearing width in a regular pattern.
  - vary clearing so as to minimize disturbance to water bodies.
- Fragment the forest edge by leaving tree clumps in the midst of cleared areas.
  - in semi-open areas, clearing should match the pattern of the adjacent vegetation, distances between created tree clumps reflecting distances between naturally occurring tree clumps.
  - leaving tree clumps at transitions between clearings and forests acclimatizes the driver to potential icing of roadway, and high to lowlight conditions.
- Feather the forest edge.
  - reflect gradation of natural forest edge. This cross section would follow forbs and grasses, shrubs, pioneer trees,through to mature forest.
  - within this buffer cut trees, leaving intact topsoil and root systems to encourage root sprout of pioneer species. This buffer zone prevents sun scald on trees whose bark is sensitive to new exposure of sunlight, and reduces susceptibility of adjacent shallow rooted trees to wind-throw.*
  - where slope exceeds 3:1, begin buffer 1m beyond end of rounding of slope.**

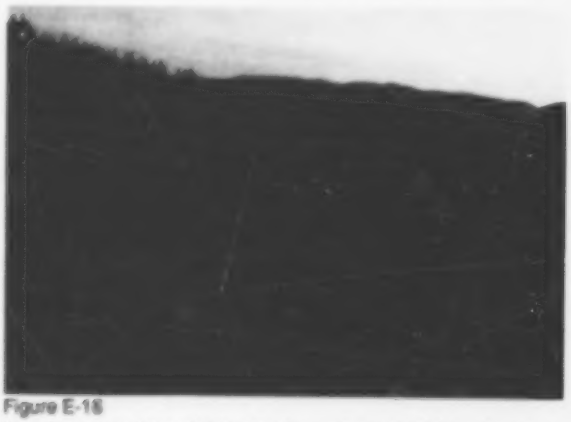


Figure E-16
Vary the edge of the clearing line to create an undulating forest edge. Avoid a forest edge which has a regular undulating pattern. Keep undulations random, and similar to adjacent natural conditions.

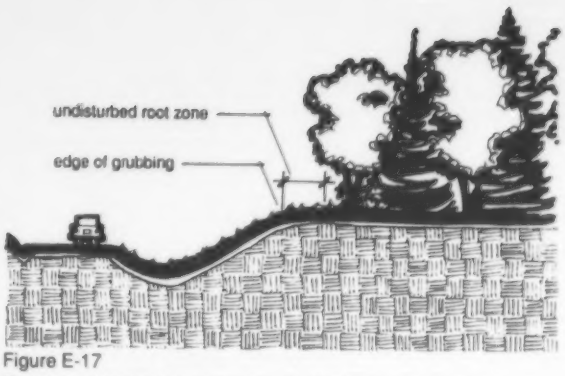


Figure E-17
Retain undisturbed root zone as required to protect trees to remain from potential wind throw hazard.

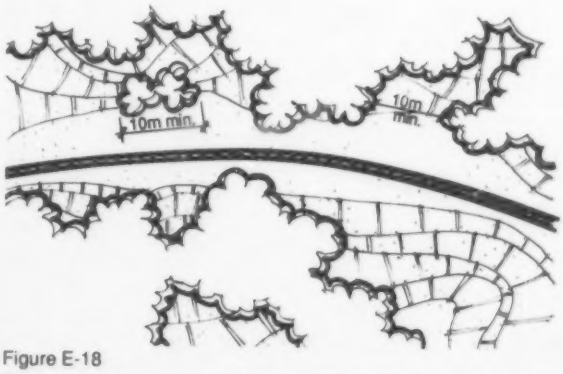


Figure E-18
Tree clumps provide variety within forest clearings.

Figure E-19
Clearing should emulate the natural forest edge transition from grasses to shrubs to pioneer trees to mature forest.

.8 Clear in response to view **from** the road and **toward** the road.

- Expose designated view for a minimum length of 0.5 seconds at the highway design speed, if **fleeting** view is desired.
- Expose designated view for a minimum length of 5 seconds at the highway design speed, if **panoramic** view is desired.
  - consider the option of limbing trees to the height required to gain desired view.
  - if the clearing length is greater than 5 seconds, consider retaining excellent tree specimens.
  - if the clearing length is greater than 10 seconds, consider retaining pattern of fragmented clump or specimen tree, typical of adjacent sites.

Figure E-21
Limbing trees can offer filtered views.

Figure E-22
In long clearings, consider retaining specimens or clumps to break up the view.

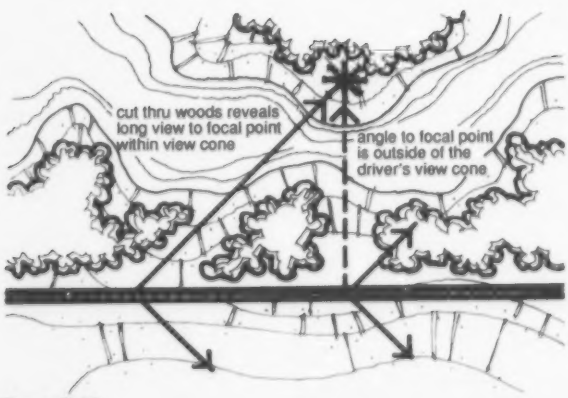


Figure E-20
Clear sufficient length and at an angle to expose the view at the design speed.

- Ensure that the minimum angle of clearing equals that of the area of effective vision.
- Minimize views of adjacent timber cuts and unsightly land uses.
- Minimize the view toward the road, especially in extreme cut/fill situations.

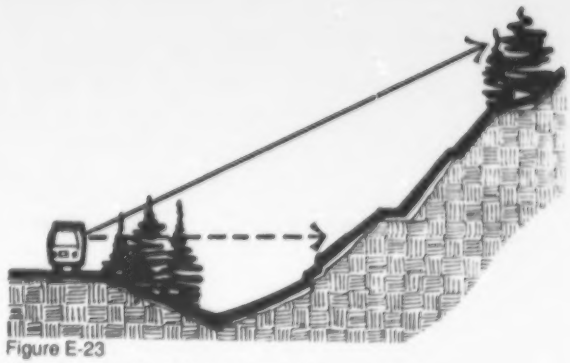


Figure E-23
Minimize views to timber cuts uphill from the road.

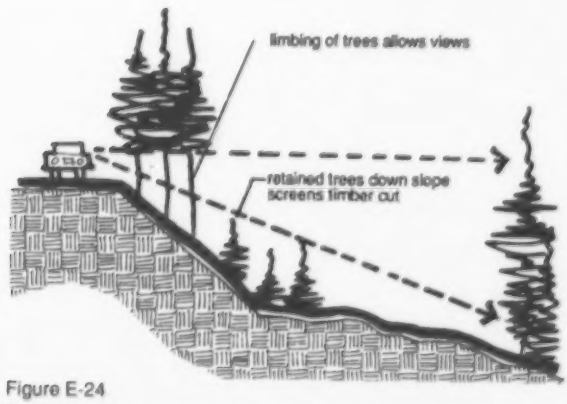


Figure E-24
Techniques for screening downhill timber cuts can be quite different than for uphill cuts.

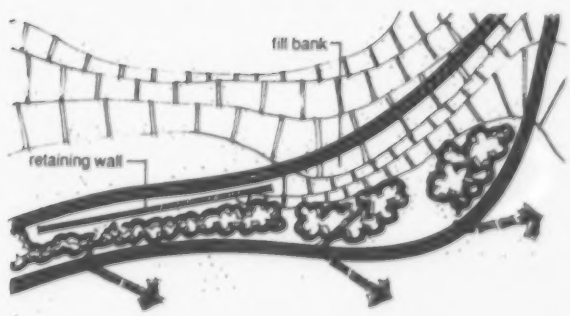


Figure E-25
Careful selective clearing and leave areas can screen fill banks and retaining walls.

5.0 Clearing of Roadside Facility Areas

Clearing and grubbing of roadside facility areas must be carried out with attention to detail, as warranted by the close inspection from pedestrians.

.1 Clear in stages to allow for reassessment of aesthetic potential.

Step 1 - Produce construction information including: detailed site contour survey, complete detailed site analysis, site plans, and grading plans.

Step 2 - After construction drawings have been prepared, clear the centre line of access/egress alignment and through lane of parking, perform detailed centre line and cross section survey, and refine road alignments and grading accordingly.

Step 3 - Field assess the site plan. Stake out major site plan elements, including building sites, recreation areas and views, and parking areas. Make adjustments to site plan in response to existing conditions and site features. Flag vegetation blocks, rock outcrops, water bodies and natural elements to be retained.

Step 4 - Complete mass clearing to limits of parking and building locations, ensuring that leave areas in parking lot islands and near buildings are protected.

Step 5 - Lay out no-cut/no-fill line, and make minor adjustments to grading plan in the field, and then clear to no-cut/no-fill line

Step 6 - Mark individual trees to remain or areas to be selectively cleared. Complete selective clearing of these areas. Clear all remaining dead, dying and wind susceptible trees, except where a snag is sound and serves habitat enhancement.

.2 Retain natural vegetation wherever feasible in roadside amenity areas.

- Allow vegetation to encroach to the pavement edge with the following exceptions:
  - for lengths of road requiring snow removal provide a cleared strip 3m wide.
  - clear only that plant material exceeding 600mm height in sight lines and site triangles required by design speeds for signs and intersections.
  - remove branches extending over pavement to a height of 5m.
  - clear all plant material exceeding 300mm height for 5m radius at building entrances.
  - clear all plant material for 1m width around picnic benches.
  - clear other plant material to provide for walkways and manicured open space where required.

.3 Bury all residue of trees, brush, weeds, roots, matted leaves, structures and other debris remaining after burning.

Figure E-26
In most roadways within roadside facilities, native vegetation should be allowed to meet the pavement edge.

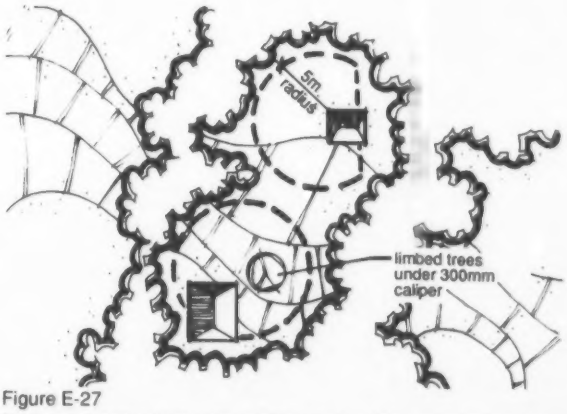


Figure E-27
Native vegetation higher than 300 mm should be removed within a 5m radius of entrances to buildings or other structures.

Figure E-28
Where picnic tables are located in the woods, allow a minimum of 1 m between table pads and trees. In this example one of these tables should have been located further away from the existing trees.

Earthworks

Earthworks

Introduction

The objective of earthwork as it relates to aesthetic highway development will be to ensure that all areas beyond the edge of the pavement relate seamlessly to the surrounding terrain. To achieve this objective engineering solutions which are safe and functional must also be designed to blend with adjacent landscapes. Where structures are incorporated as part of highway design, earthworks will provide the transition between the structural element and the surrounding terrain.

The co-ordination of engineers, designers and consultants from the initial stages of corridor and alignment selection through into preparatory work to detail design is essential to identify and incorporate responsive earthwork plans.

Specific earthwork circumstances addressed in this section include the following:

- **Borrow pits, settling ponds, and basins** which should be graded to blend with the adjacent landscape character.
- **Blast cuts**, particularly where they form part of the skyline.
- **Ditches** which can be graded to integrate with the adjacent terrain.
- **Uphill and downhill slopes** where grading issues can be considerable in areas of steep terrain.
- **Medians** which can be developed to include borrow pits and bermed areas and become a source of visual interest.
- **Culverts** which should be detailed to create a minimum visual impact.
- **Berms** which should be well integrated with adjacent topography.
- **Avalanche barriers and retaining structures** should be graded to blend into the surrounding landscape character.
- **Bridges, overpasses, and interchanges** should be developed to respond to aesthetic objectives and tie into the earth naturally at their foundations.
- **Roadside facilities** require specific attention to earthwork development as a result of the close scrutiny they receive from pedestrian traffic.

Recommended Practices

The following pages outline recommended practices concerning the aesthetics of earthworks associated with highways in B.C., as summarized below:

1.0 Decide routes to, and location of borrow pits, storm run-off retention ponds and silt settling basins before clearing commences.

2.0 Analyze soils, their potential for and means to mitigate erosion.

3.0 Reflect the natural conditions of the adjacent terrain.

4.0 Apply these standard guidelines for earthworks to all areas impacted by roadway development.

Note: Construction will not be considered complete until site revegetation has been accomplished on all earthworks.

1.0 Location of Borrow Pits, Surplus Disposal, Ponds, and Basins.

Decide routes to, and location of borrow pits, surplus disposal sites, storm run-off retention ponds and silt settling basiins before clearing commences.

.1 Integrate borrow pit, and surplus disposal site location with highway desiign.

- Identify features within right of way which may be used as fill in lieu of borrow pits.
  - remove landforms which obscure operattional safe sight distances (eg. remove roadside grade on inside curve, which obscures passing sight distance; maximum 600mm height above pavement elevation).
  - eliminate peculiar or view-obstructing remnants of cuts.
- Limit use of ditch/swale area for borrowing of fill.*

*refer to EARTHWORKS (Ditches) for design details

**refer to ALIGNMENT (Drivers Interest and Experience) for applicable locations.

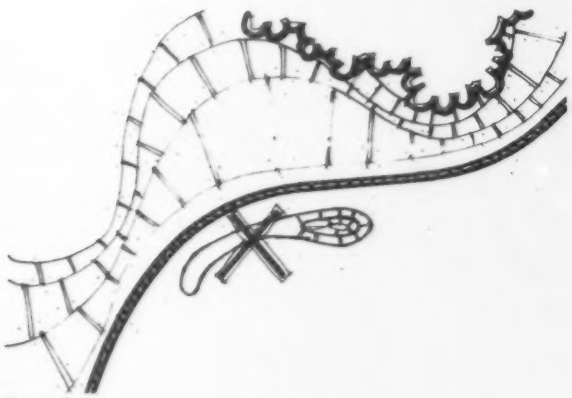


Figure F-1
Remove landforms as required for safe sight distance.

- Locate borrow pits to be adapted to other uses.*
  - simulate naturally occurring depression within median or "lay backs" in right of way cut to provide topographical relief.
  - create depressions for use as sloughs or ponds for potential wildlife and aesthetic value.
  - allocate for slash and scree disposal.
  - fill and rehabilitate for roadside facilities.
  - convert to settling basin.

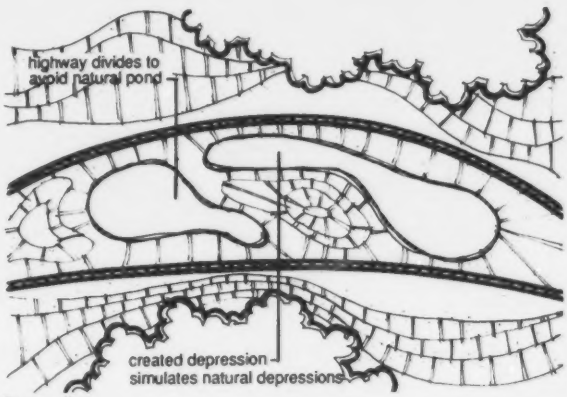


Figure F-2
Borrow areas within the right of way can be shaped to resemble naturally occurring topography.

Figure F-3
This substantial fill disposal site is largely concealed from the highway because of the vegetation left at the roadway edge.

- Minimize the visibility of those borrow pits and disposal sites to remain after completion of highway.
  - separate by minimum 20m wide vegetative screen exclusive of right of way clearing requirement.
  - intersect access road with the primary road at a 90 degree angle. The tangent of the access road at the intersection should be no longer than 15m with the curve leading into this tangent of no less than 15 degrees.**

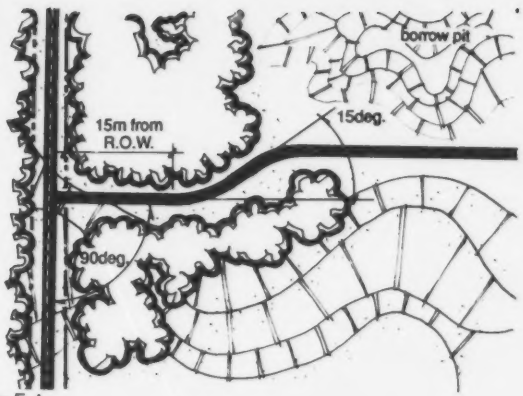


Figure F-4
Borrow pits and access routes to pits can be screened by vegetation. Locate borrow pit and access road to leave effective vegetation buffer.

Figure F-5
This permanent quarry site would have been better located further from the roadway edge and concealed from view by a vegetated buffer.

.2 Integrate retention pond and settling basin location with highway design.**

- Integrate permanent erosion control measures (eg. storm run-off retention ponds and silt settling basins and their channels) with the natural drainage system.
  - identify naturally occurring depressions within and adjacent to right-of-way to be cleared and/or reshaped.***
- Rehabilitate all areas within view of completed highway used for temporary erosion control measures.***

Figure F-6
This retention pond located within the right of way could have been designed to create a more naturalistic shape.

*refer to ALIGNMENT (Drivers Interest and Expenence) for applicable locations.

***refer to VISUAL RESOURCE ANALYSIS for environmental constraints

***refer to CLEARING AND GRUBBING for space requirements and implications to existing vegetation.

***refer to EARTHWORKS and REVEGETATION for integration with adjacent site conditions and erosion control.

2.0 Site Preparation

Assess soils to determine their potential for subsequent revegetation.

.1 Retain topsoil for future use in revegetation.

- Strip and store all usable topsoil. Sub-soil horizons where high organic content exists may also be stripped and stored if required. Where abnormally deep topsoil exists store only the amount required for the project.
- Locate storage areas and haul routes to within known clearance areas.
  - store on well drained area of right of way.
  - store in linear mounds 3m wide to a height of 1.3m, with 3:1 sideslopes. Wider piles should be limited to a maximum height of 1m.

Figure F-7
Stockpile topsoil within the limits of cleared areas in well drained areas.

.2 Conserve the use of retained topsoil for areas of high visibility and areas to be revegetated with trees and shrubs.

Figure F-8
Topsoil samples should be collected from the site and tested to determine nutrient content, texture, and structure.

Figure F-9
Topsoil should be retained for areas of high visibility, which are most likely to be revegetated with trees or shrubs, such as interchanges.

3.0 Integration with Adjacent Topography

Reflect the natural conditions of the adjacent terrain.

.1 Avoid a constant width of grading.

- Vary the angle of slope over the length of the slope.
  - warp the slope to acknowledge drainage channels or "lay backs". Slopes will reflect angle of repose of soil.
  - create "lay backs", where cut slope exceeds 5 seconds in length at highway design speed. The warp, width of mouth, and length should be typical of adjacent natural terrain.

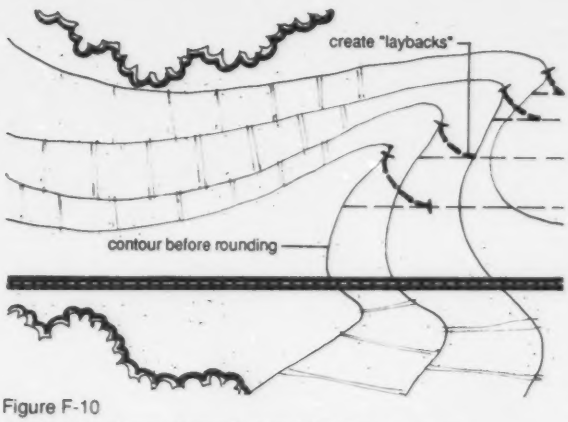


Figure F-10
At natural drainage channels, blend the slope to create 'lay-backs'.

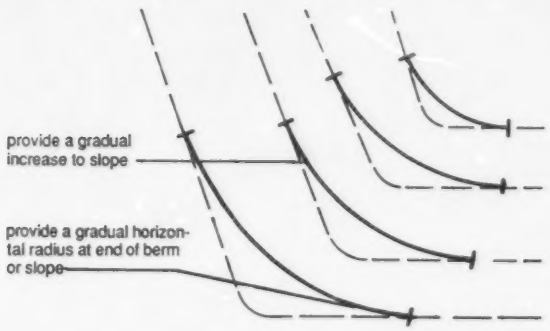


Figure F-11
Typical feathering of the ends of a slope.

- Feather the ends of the slope.
  - provide a transition from the maximum angle of slope to blend in with the adjacent site, with warp typical of adjacent natural terrain.
- Round the toe and top of slope.
  - provide a minimum radius of 3m at the top of slope to blend the midpoint angle of slope to the adjacent undisturbed site.
  - provide a minimum radius of 3m at the toe of the slope to blend the midpoint angle of slope to the adjacent undisturbed site.

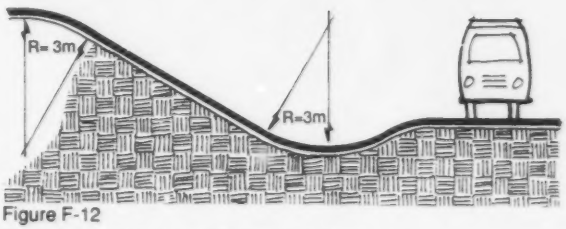


Figure F-12
Typical rounding at top and bottom of slope.

.2 Ensure that the length of slope matches the scale of the angle of slope typical to the adjacent terrain.

- Avoid the appearance of unnatural steepness on short slope lengths.
  - for cut or fill slopes of less than 1.5m ht. use a maximum slope of 4:1.
  - for cut or fill slopes between 1.5 - 3.0m ht. use a maximum slope of 3:1.
- For slopes of cut and fill exceeding 3.0m ht. consider all slopes visible within the viewshed.*
  - use maximum 3:1 slope on slopes of erodible soils or areas to be mowed.
  - where feasible do not exceed the slope of dominant background hills and mountains in view.

Figure F-13
Avoid the appearance of unnatural steepness on short slope lengths.

.3 Retain and incorporate naturally occurring landforms within the cut and fill area where immediately visible from the highway.

- Retain natural drainage channels.
  - alter slope to blend with natural drainage or "lay backs" (eg. transition of 2:1 to 3:1 to 4:1 vertical slope).
  - transitional slope is continuous to the most gradual slope, at centre of layback.
  - minimum length of layback at mouth should be equal to 0.5 sec. at highway design speed.
- Retain naturally occurring rock outcrops and ridge lines where feasible.

Figure F-14
These naturally occurring laybacks can be reproduced during earthworks design and construction.

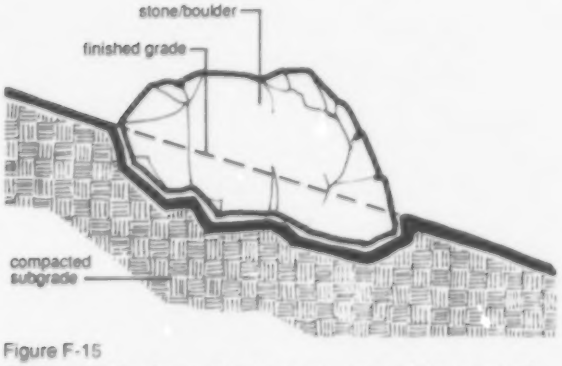


Figure F-15
Grade around rock or rock outcrops so as to maintain a natural appearance.

.4 Avoid disturbance of waterbodies.

- Avoid encroaching fill upon water bodies.
  - maintain, wherever possible, 15m minimum separation between the no-cut/no-fill line and the edge of fish bearing water bodies, 7.5m minimum separation from all other year-round running water courses.*
- Avoid excessive channelling and erosion from cut/fill slopes and ditches.
  - provide transitional "bell mouth" swale and feathering of end slopes where ditches and slopes intersect water courses.**
  - where required for erosion construct rough bed channel of rock material typical in scale to that in the adjacent site.***
- Consider the use of bioengineering techniques.****

*refer to HIGHWAY STRUCTURES for alternative use of retaining walls.

**refer to CLEARING AND GRUBBING AND REVEGETATION for integration with adjacent vegetation.

***refer to EARTHWORKS for dutails of construction

****refer to REVEGETATION for bioengineering.

Figure F-16
Typical 'bell-mouth' swale and related feathering.

.5 Avoid disturbing trees to be retained.

- Avoid disturbance of soil within the tree canopy.
  - limit toe of slope of fill to tree canopy line.
  - allowances may be made where protective retaining walls are impractical. Fill of up to 0.5m over 50% of the root zone is allowed for deep taproot species.*
  - avoid cut within 1m of tree canopy line. **
- Provide fencing and flagging necessary to protect the vegetation to be retained.

.6 Match fill material top dressing with that of adjacent terrain.

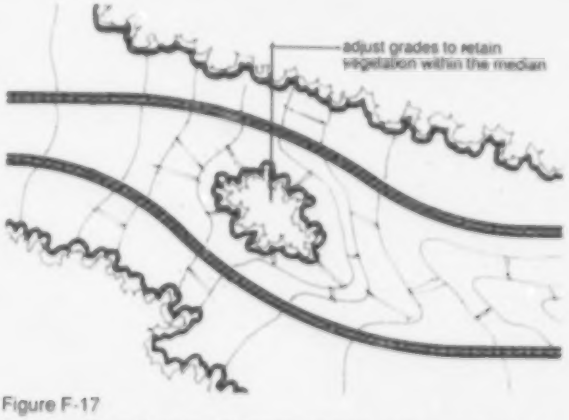


Figure F-17
Design earthworks to avoid damage to trees and vegetation to be retained.

Figure F-18
Avoid fill over the roots of trees to be retained unlike what has been done in this photo.

4.0 Application of Earthwork Guidelines

Apply these standard guidelines for earthworks to all areas impacted by roadway development.

.1 Blast Cuts

- Expose natural rock fractures where slope stability is not a factor.
  - employ random or "wild cat" blasting to best expose or simulate natural rock fractures.
  - avoid or vary pre-split blast lines where visible immediately adjacent to highway.
- Provide non-uniform (staggered) bench sections, where slope stability is a concern.
  - vary the riser height (minimum 2m) to match natural rock strata lines. Provide a minimum 2m wide bench to accommodate revegetation.*
  - additional benches should be constructed using random blasting techniques and created to simulate natural rock features.
- Treat exposed rock face to match adjacent undisturbed site, or to match adjacent cut faces.
  - scarify rock faces to mask blast lines.
  - scarify rock faces and spray liquid fertilizer for rapid revegetation of rock faces.*
  - spray asphalt emulsion to match the colour of all adjacent newly exposed broken rock and that of adjacent undisturbed exposed rock.
- Match the colour of protective wire mesh to that of adjacent undisturbed exposed rock.
- Bury excess scree.
- Recognize the possible need for changes in the field related to the location or form of blast cuts for aesthetic reasons.

*refer to REVEGETATION for revegetation and hydroseeding.

Figure F-19
Example of blasted rock face which simulates a natural rock outcrop.

Figure F-20
Example of a smooth wall blasted rock face incorporating benches for stability.

.2 Ditches.

- Minimize the visual impact of the ditch adjacent to the road.
  - limit ditch depth to the minimum required by geotechnical considerations.
  - limit side slope of ditch to maximum 3:1 slope. As adjacent terrain flattens consider more gradual ditch side slopes. (eg. flatlands may use ditch side slopes of up to 14:1).
  - round bottom of ditch.
  - consider perforated drains to drain granular sub-base.

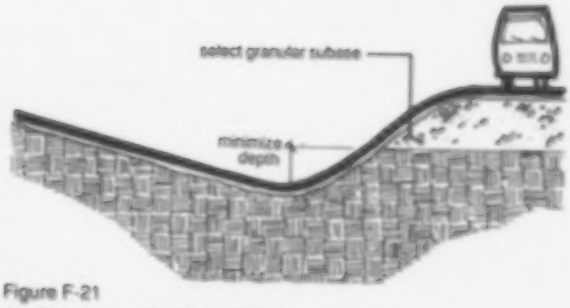


Figure F-21
Avoid excessive depth of ditches.

Figure F-22
Make ditch side slopes as flat as practical, and relate to adjacent terrain.

- Integrate ditch with adjacent terrain.
  - vary distance between ditch and pavement edge up to 15m. Change direction of ditch at 15 degrees minimum with 20m minimum radius. For example, change tangent for distance equal to 3 - 5 seconds at highway design minimum speed.
  - provide gradual transition between slopes, maintain angle of slope for 20m minimum.
  - construct a transitional "bell mouth" swale where the ditch intersects with a valley or "lay back".
  - construct a transitional "bell mouth" swale where the ditch requires widening to accommodate increased run-off, or to correct areas prone to siltation or erosion of fill section.

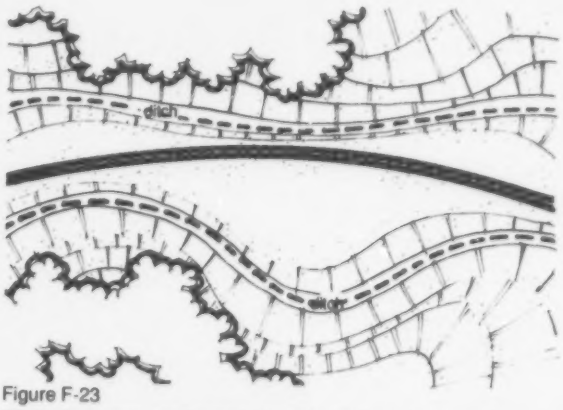


Figure F-23
Ditch alignments need not be parallel with the edge of pavement. Ditches should respond to adjacent terrain.

Figure F-24
Consider perforated drains rather than ditches to drain granular sub-base, where longitudinal slope is adequate.

.3 Medians

- Retain existing ponds, sloughs, and marsh.
  - preferably, maintain 7.5m minimum distance between no-cut/no-fill line and edge, as defined by environmental assessment.
  - where 7.5m minimum distance cannot be complied with, slope at 4:1 maximum.
- Blend created ponds or retention basins to simulate naturally occurring depressions.
  - preferably, provide 20:1 slope for a minimum length of 5m from waters edge.
  - maximum water level to be at 150mm below select granular subbase.
- Minimize the visual impact of ditches.
- Minimize visual impact of median berm.
  - slopes of median berms should be as flat as feasible - not exceeding 3:1.
  - provide berm for mitigation of headlight glare, only if 4:1 or flatter slope is possible.

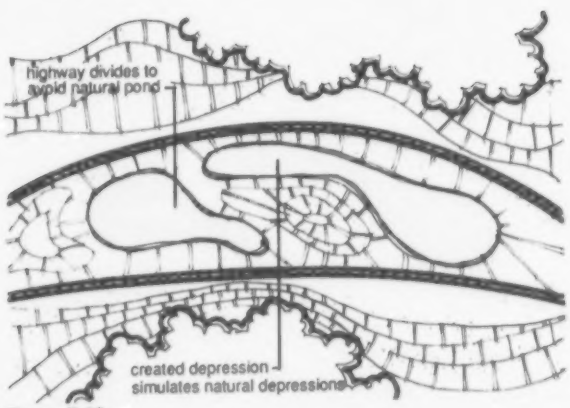


Figure F-25
Blend created ponds or created retention basins to simulate naturally occurring depressions.

.4 Culverts

- Taper or bevel culvert end.
  - taper at a 3:1 maximum slope. Fine grade along entire length of culvert edge.

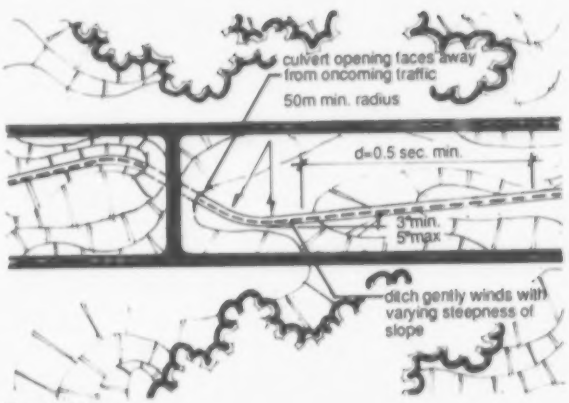

culvert opening faces away from oncoming traffic
50m min. radius
d=0.5 sec. min.
3% min.
5% max
ditch gently winds with varying steepness of slope

Figure F-26
Minimize the visual impact of ditches and steepness of slopes in medians.

Figure F-27
Typical culvert end with concrete flare. See Figure A-4 for alternate example.

.5 Berms

- Avoid erratic and monotonous screening of unsightly views.*
  - construct berms for a minimum length equal to 0.5 seconds at highway design speed, and a maximum length equal to 10 seconds at highway design speed.
  - warp side slope of berm, with a maximum slope of 4:1, at a distance equal to 0.5 seconds minimum, 5 seconds maximum, and 3 seconds maximum at highway design speed.
  - vary the height of berm from a minimum 1.5m above the finished grade elevation of the highway.
  - provide gaps between berms not exceeding 20m.

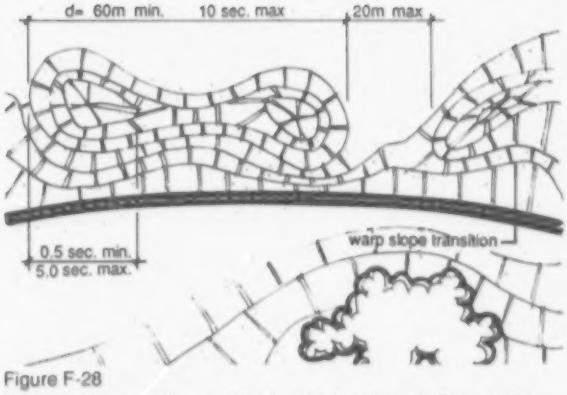


Figure F-28
Construct berms with a varying height, length and alignment to avoid visual monotony.

- Provide effective but attractive screening to mitigate headlight glare.**
  - berms, specifically installed to mitigate headlight glare, should be a minimum length of 60m and a maximum length equal to 10 seconds at highway design speed.
  - provide gaps between berms not exceeding 20m.
  - warp side slope of berm with a maximum slope of 4:1, at a distance equal to 0.5 seconds minimum, and 3 seconds maximum at highway design speed.
  - vary the high point of the berm from a minimum 1.5m above the finished grade elevation of the highway, to a minimum 1.8m where commercial truck traffic predominates.
- Integrate berm with adjacent terrain.
  - vary the distance between the pavement edge and the toe of the berm slope at a minimum distance of 10m.
  - alternately, align the berm to not be parallel with the road. Align berm 5 degrees minimum, 15 degrees maximum off parallel, with minimum curve radius between tangents of 5m.
  - minimum width of warp at toe of slope should be equal to 0.5 seconds at highway design speed.

**refer to ALIGNMENT for appropriate location for berms.*

***refer to VEGETATION MANAGEMENT for combined or alternate use, where these measures prove inadequate.*

.6 Uphill Slopes

- Limit lengths of constant uphill slopes beside the highway.*
  - warp the slope and/or create "laybacks" where slope exceeds distance equal to 5 seconds at highway design speed.
- Warp slope to tie into existing grade at the end of tangent.

.7 Downhill Slopes

- Relax base standards for earthworks where circumstances warrant.
  - consider use of retaining structures where earthwork required to meet grade is excessive in scale.
  - consider use of retaining structures where existing vegetation may be retained to screen road and downhill earthworks.
  - consider use of retaining wall to allow for encroachment of vegetation for variety of enclosure along roadside.

*refer to REVEGETATION for alternate methods of providing variety to slopes.

.8 Avalanche Barriers

- Integrate avalanche barrier with adjacent terrain.*
  - blend ends of barrier into adjacent slopes.
  - feather the end of slope.
  - blend "lee" side slope with ditch bank slope to give appearance of one contiguous slope.
  - provide a warp, or varied slope, to the "lee" side of avalanche barriers which exceed 5 sec. in length. Maximum side slope should be 4:1. Minimum width of warp at toe of slope should be 0.5 seconds or greater at highway design speed.

*refer above for transition of slopes at end, toe and top

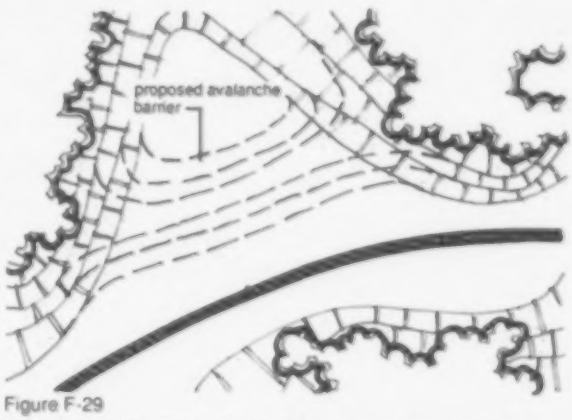


Figure F-29
Blend the ends of the avalanche barrier into adjacent terrain.

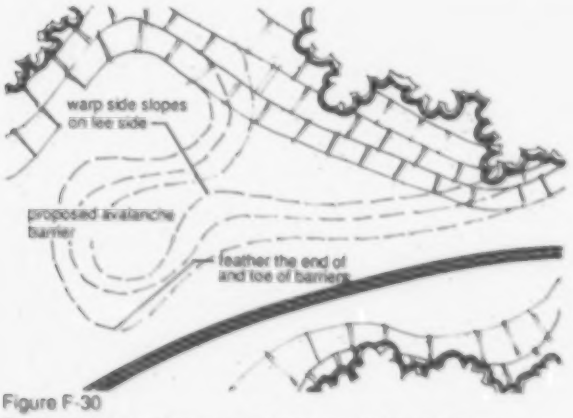


Figure F-30
Feather the toe and warp side slopes on the lee side of the barrier.

.9 Retaining Structures

- Provide a consistent and visually clean silhouette at top of wall. (Applicable to **upslope and downslope** conditions.)
  - top of wall should follow natural terrain to be retained, or reflect roll of natural terrain typical to the region.*
  - for **cribbing** construction, step elevation of top of wall up or down in equal increments.
  - for **poured in place** construction, maintain consistent top of wall, or alternately maintain top of wall at constant slope, for distance stated below.
  - irrespective of natural terrain to be retained, avoid "roller-coaster" effect. Maintain stepping/sloping of wall up or down for a minimum length equal to 0.5 seconds at highway design speed. Constant sloped top of wall should change from up to down slope with 5m minimum radius.
  - meet top of wall with fill for entire length of wall.
- Fit bottom of wall to adjacent terrain. **(Applicable **only to upslope** conditions)
  - parallel the bottom of wall elevation with that of highway elevation.
  - commence slope, at 4:1 maximum, at bottom of wall 1m in front of wall. ***
  - wrap earthwork around the end of wall. Grade earthwork from typical bottom of wall elevation, commencing at a maximum of one-third of the total length of the wall, from the end of the wall, at a maximum 3:1 slope.
  - at the end of wall, the earthwork should meet the top of wall. Alternatively, if a no post traffic barrier must be placed at the end of the wall, the wall height should be equal and integrated flush with the traffic barrier. Material may be retained behind the traffic barrier.

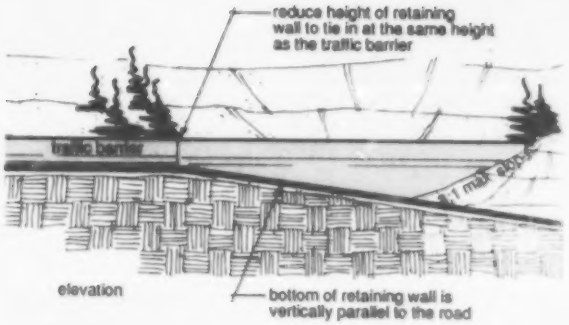

reduce height of retaining wall to tie in at the same height as the traffic barrier
traffic barrier
1 max slope
elevation
bottom of retaining wall is vertically parallel to the road

Figure F-31
Elevation of typical retaining structure.

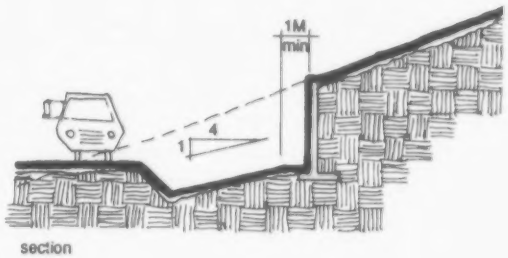


Figure F-32
Section through typical retaining structure.

refer to REVEGETATION for revegetation at top of wall.

**refer to HIGHWAY STRUCTURES for height of walls.*

***refer to REVEGETATION for revegetation at bottom of retaining structures.*

.10 Bridges

- Screen the spring point of the bridge from the approach angle of highway. Heighten the dramatic relief once on the bridge.
  - maintain cut as close as feasible to the road.
- Alternatively, visually open a view from the approach angle of the highway.
  - grade so that the view is opened toward the bridge.
  - provide terrace for viewing of bridge commensurate to safety requirements. Provide a terrace 15m minimum width, 20m minimum length, at a maximum cross slope of 6%. This will accommodate revegetation and/or future possible pullout/rest area.

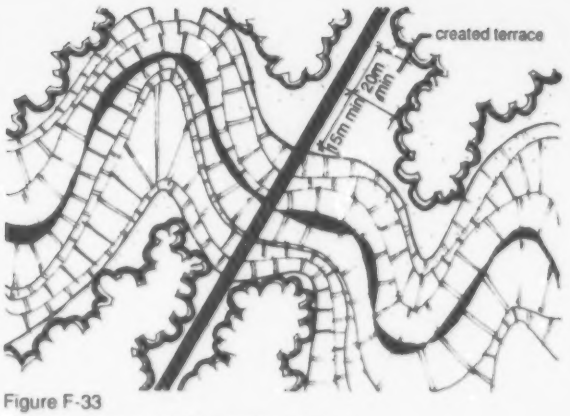


Figure F-33
Create a terrace at bridge spring point.

.11 Overpasses

- Accentuate intended silhouette of overpass design.
  - limit slope under a span to 2:1 maximum, feathering ends of slope to adjacent terrain.
  - retaining devices should be integrated with adjacent traffic barriers and tapered into adjacent slopes.

.12 Interchanges

- Treat ramps and adjacent terrain as one integrated form.
  - where applicable blend ramp slope into retained pond, slough, and marsh, or created retention basin.
  - slope ramp side slopes at 4:1 maximum.
- Emphasize decreasing or increasing design speed of ramp.*
  - flatten side slopes of ramp and ditches in proportion to desired increase in speed.
  - steepen side slopes of ramp and ditches in proportion to desired decrease in speed.
  - decrease the distance between the pavement edge and the toe of berms in proportion to desired decrease in speed.

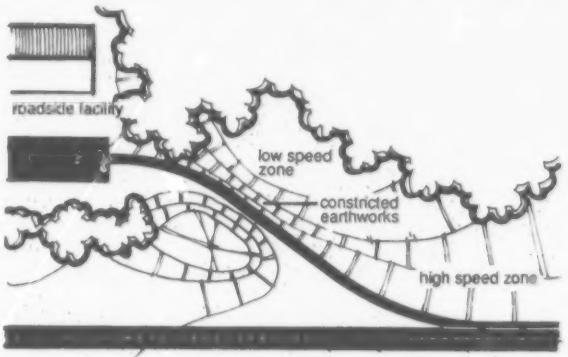


Figure F-34
Emphasize design speed changes with earthworks.

refer to ALIGNMENT for maximum heights allowed within sight triangles and distances.

.13 Roadside Facilities

- Avoid ditches directly adjacent to roadside facility access road, parking areas, and walkways.
  - preferably, align ditches to the facilities site perimeter.
- Minimize the visual impact of ditches which must appear adjacent to roads, parking areas, and walkways.
  - set back ditch top of slope 1.5m from edge of pavement edge or walkway.
  - maintain the minimum possible depth of ditch.
  - width of ditch, measured from top of slope to top of slope, should be six times the depth of ditch.
- Eliminate ditches wherever possible.
  - facilitate drainage over pavement.
  - facilitate drainage by underground pipe or drain.
- Facilitate access by the physically challenged to site.
  - maintain 20:1 maximum slope for parking areas, and internal roads.
  - maintain 8:1 maximum slope for curb ramps.
  - maintain 20:1 maximum slope for primary walkways. Where required, primary walkways may be 12:1, with maximum distance between landings 9m, landings minimum 3m in length. A 920mm high rail on one side should be provided.
  - maintain 10:1 maximum slope for secondary walkways (no rails, personal assistance).
  - maintain 30:1 maximum slope for a 1.8m distance on all sides of picnic tables, seating, and facility entrances.
- Emphasize desired road speeds and attention to pedestrian/vehicle conflicts.
  - maintain 600mm maximum height of vegetation above finished road elevation, within sight triangles at the intersection of roads.
  - maintain 300mm maximum height above finished road elevation, within sight triangle at the intersection between roads and parking areas and walkways.

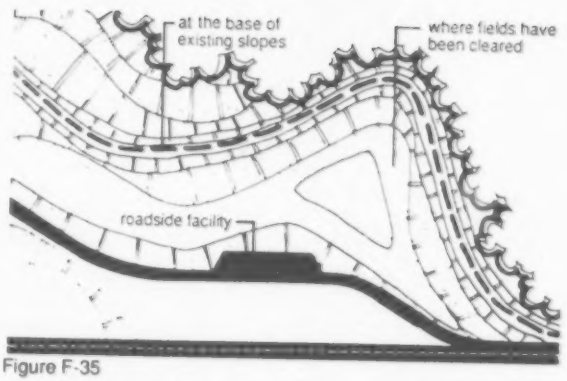


Figure F-35
Align ditches at roadside facilities to be the least visible, usually at the site perimeter.

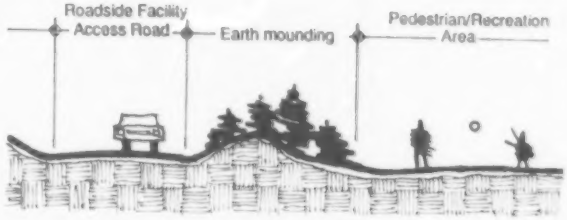


Figure F-36
Earthwork techniques can emphasize roadway speed limits and reduce pedestrian/vehicle conflicts.

Revegetation - Vegetation Management

Revegetation - Vegetation Management

Introduction

Highway construction usually involves large scale disturbance to the surrounding landscape. Existing vegetation is cleared from the highway corridor to accommodate changes in grade, the new roadway, and other related facilities. As a result of these changes large areas will become susceptible to erosion, loss of topsoil, and the invasion of weed species. In dealing with these issues revegetation is an important part of the highway design process.

Other chapters in this manual have addressed aesthetic design issues such as alignment, selective clearing, and earthworks which can effectively minimize these negative impacts. Still, the re-establishment of vegetation on affected areas is extremely important not only for aesthetics, but for functional reasons, including erosion control and maintenance.

There is opportunity during highway design to not only preserve desirable vegetation, but to plan for the type of planting suited to the right of way involved. Wise decisions made during the design stage will result in better integration of aesthetic and functional aspects, and ensure maintainability after construction.

Well managed revegetation practices can play a major role in meeting the following objectives:

- controlling erosion.
- reducing problems associated with headlight glare, sun glare, and snow and ice accumulation.
- creating visual interest along the highway.
- screening unsightly conditions.
- framing and providing access to views.
- reducing the visibility of the road from adjacent areas.
- guiding traffic and providing "soft" impact areas for errant vehicles.
- blending the highway into the adjacent landscape.
- facilitate appropriate levels of maintenance.

The Ministry's Landscape Policy and Standards references three categories of landscape treatment, based on, rural, suburban, and urban locations. Revegetation practices should be responsive to specific requirements for each of these areas.

Recommended Practices

The following pages outline recommended practices concerning the aesthetics of revegetation associated with highways in B.C., as summarized below:

1.0 Site preparation must meet requirements as determined by the Ministry.

2.0 Revegetation must maintain operational highway design safety requirements.

3.0 Revegetation should enhance attractive views and screen negative views from the road.

4.0 Revegetation should enhance attractive views and screen negative views toward the road.

5.0 Revegetation should respond to the natural vegetation and habitat of the site.

6.0 Revegetation should minimize erosion and assist in the stabilization of cut and fill slopes.

7.0 Revegetation should minimize the effects of adverse climatic conditions.

8.0 Revegetation should minimize the negative implications of increased traffic volumes.

9.0 Maintain adequate setbacks to both above and underground services.

1.0 Site Preparation

Preparation of the site must be in accordance with requirements established by the Ministry for the various levels of landscape treatment. This manual is based upon the rural category. The following recommendations are considered basic practice for all areas.

.1 Provide adequate subgrade preparation.

- Rough grade to produce lines and grades shown on the drawings.
- Blend existing landforms into the graded areas to create a minimum of visual disharmony.
- Scarify subgrade to a minimum depth of 100mm.

.2 Provide topsoil of adequate depth and quality to ensure healthy plant growth.

- Where it is impractical to topsoil large cut and fill slopes, or topsoil is unavailable, concentrate efforts to adequately prepare existing conditions for receiving seed and plant material.
- Salvage existing topsoil and soil strippings, stockpile, and reuse on disturbed areas wherever possible.
- Where topsoil is available, provide a 300mm depth for shrub planting, and a 450mm depth for tree planting holes.
- When planting into existing material, scarify the bottoms of planting holes and allow for drainage.
- Consider providing limited amounts of topsoil for individual holes when existing conditions are very poor.

.3 Provide adequate water supply to ensure healthy plant growth.

- In rural applications, the establishment of vegetation is dependant on rainfall and existing soil moisture. Revegetation plans should require no supplemental watering.
- Limit installation of irrigation systems to those circumstances where it is essential to plant survival and appearance.*

*refer to REVEGETATION (Response to Natural Vegetation) for specification of appropriate species of plant.

Figure G-1
Once rough grades have been established topsoil will be spread to depths required to ensure adequate plant growth.

2.0 Operational Safety Distances

Proposals for revegetation must recognize and maintain operational highway design safety requirements.

.1 Maintain safety setbacks.

- Limit plantings of trees whose mature diameter exceeds 100mm to the following setback distances. These setback distances can and should be relaxed where retaining walls and traffic barriers are proposed.

90km/h or greater	=	10m from pavement edge
80-90 km/h	=	7m from pavement edge
60 - 80km/h	=	6m from pavement edge
60km/h or less	=	2m from pavement edge

- Emphasize desired increase or decrease of design speed by modifying tree setback distance accordingly.
- Maintain minimum vertical clearance of 5m over pavement. Revegetation proposals should incorporate tree species with a natural branching structure which can accommodate this requirement.
- Provide setbacks to treeline for special conditions as follows:

passing distance to allow minimum passing sight distance at design speed

signs minimum horizontal setback distance of 2m or as necessary so as not to obscure reading of the sign

intersections distance required to respond and react

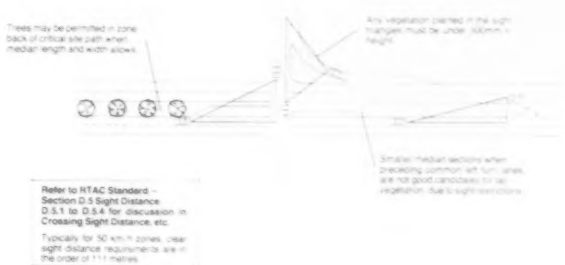
driveways & access roads minimum horizontal distance of 2m

rail crossings (uncontrolled) distance, measured from the crossing of the minimum stopping distance for the highway design speed and, distance, measured from the crossing, travelled by the train equivalent to the interval required for the vehicle to stop. Railway Act Regulations for sight distances must be adhered to.

.2 Maintain height restrictions within sight triangle at intersections and sight distance areas.

- Specify plant material whose mature height will not exceed 600mm above the finished elevation of the highway within critical sight distance areas.

**refer to REVEGETATION and CLEARING AND GRUBBING for required safety setbacks.*



SIGHT DISTANCES AT NON-SIGNALIZED CROSSINGS

Figure G-2
Vegetation within the area of sight triangles should be kept less than 300 mm height above the level of pavement. Refer to the Ministry of Transportation and Highways Landscape Policy.

3.0 Response to Views from the Road

Revegetation will maintain and enhance attractive views and screen or minimize negative views from the road.

.1 Revegetate to frame and define desirable views from the road.

- Maintain designated views for a minimum length equal to 0.5 seconds at the highway design speed if **fleeting** view is desired.
- Maintain designated views for a minimum length of 5 seconds at the design speed if **panoramic** view is desired.
  - consider the option of selective clearing, and/or limbing of remaining or planted trees to the height required to maintain desired view.
  - if the cleared length is greater than 5 seconds, consider retaining or planting specimen trees.
  - if the cleared length is greater than 10 seconds consider retaining or planting pattern of fragmented clump, or specimen tree, typical of adjacent context.

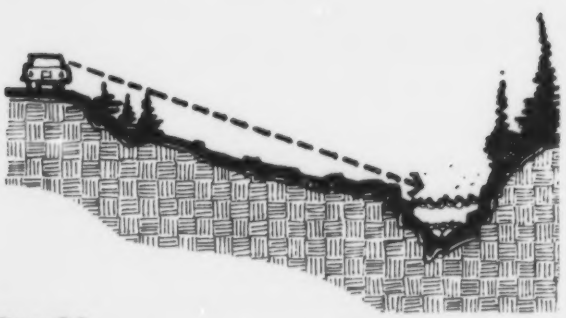


Figure G-3
Where attractive views exist, limit the height of foreground vegetation.

.2 Use the Area of Effective Vision to determine where revegetation will be most effective in screening or framing views.

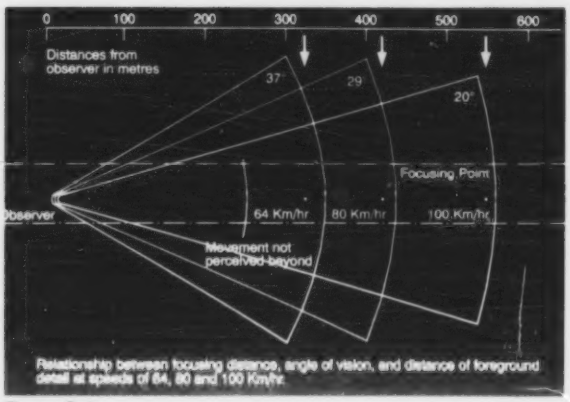


Figure G-4
Note that revegetation undertaken within the darkly shaded areas of this 'Area of Effective Vision' diagram will be more effective in screening and framing views.

.3 Screen erratic or confusing views.

- Provide screen where alignments of highway, or alignments of highway and frontage road converge.
  - provide a screen of 3m minimum in width, of a height which blocks the view of other alignment within the area of effective vision for the highway design speed.
- Provide screen of frontage roads which parallel within 20m of highway.
  - provide a screen of 1.5m minimum in height above the finished grade of highway, 3m minimum in width.
  - provide a minimum length of 60m and maximum length equal to 5 seconds at highway design speed.
  - breaks in screen should not exceed 20m.

Figure G-5
Revegetate to screen at convergence of alignments and between highway and frontage roads which parallel within 20m.

- Revegetate open ends of tangents.
  - revegetate the front edge of natural or created clearings (eg. abandoned roadways, construction areas) within forests beginning within foreground area of effective vision, with plant material whose mature height will equal that of adjacent predominant plant material.
  - revegetate openings to utility corridors which appear at the end of tangents.
- Revegetate the ends of tangents in open terrain.
  - plant trees typical in arrangement and species to region.
  - in areas dominated by grid land use pattern, or in areas with dominant hedge or shelterbelt planting, plant minimum 5 trees in row. Begin row at the end of tangent and align with curve of roadway.
  - in areas not dominated by above conditions, plant 1 landmark tree, or minimum 5 trees together for grove effect.

Figure G-6
Revegetate the open ends of tangents.

.4 Screen unsightly views.

- Minimize the effect of utility corridors.
  - screen the groundplane of the cleared right of way when viewed from distances up to 5km, where utility corridors cut through forest.
  - screen high voltage powerlines viewed from distances up to 1.5km in terrain dominated by trees.
  - where underground utility corridors, aboveground high voltage powerlines, or maintained haul routes intersect with the highway ensure that vegetated screens are designed to create a natural transition between natural and revegetated areas.

Figure G-7
Screen the view to utility corridors when viewed from a distance of within 5km.

- Minimize the effect of timber cuts.
  - provide vegetation of a height required to screen adjacent timber cuts. Where attractive views exist beyond cut, limit height accordingly.
  - where dominant straight lines of timber cut intersect cleared highway right of way, feather edge of cut for a 10m minimum width.

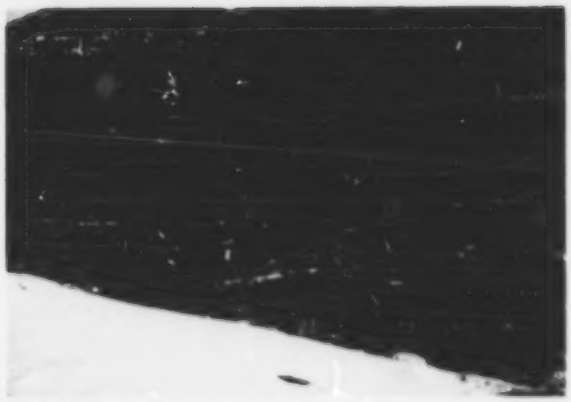


Figure G-8
Alignments which expose timber cuts within 5km of the roadway will negatively impact the aesthetic quality of the driving experience.

- Screen unsightly land uses i.e.: (junkyards, garbage dumps, quarries, and field camps) where visible within 1.5km from highway.
  - provide a 20m minimum planted buffer of a height and length necessary to screen the entire groundplane of the site.
- Screen the parking areas and yard operations of all other commercial businesses immediately adjacent to the highway.
  - provide a 3m width minimum of dense evergreen vegetation, of a height necessary to screen the groundplane of the commercial business. Height should not exceed that which would screen view of business sign from the highway.
- Where no opportunity to screen unsightly view exists, evaluate opportunity of providing attractive feature which diverts attention.
  - open attractive views in the opposite direction.
  - alternatively, provide exceptional plant display with distinctive grasses, wildflowers, groundcovers, and flowering shrubs within right of way.

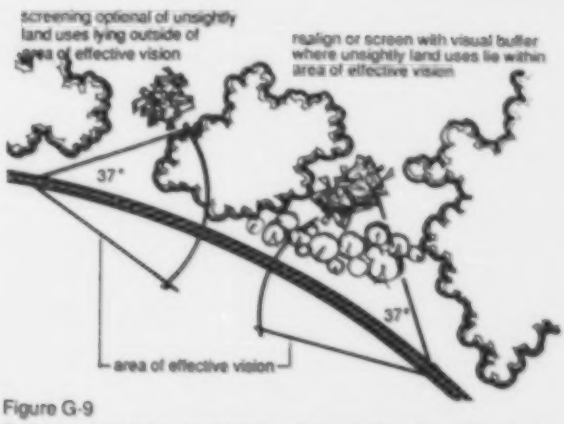

screening optional of unsightly land uses lying outside of area of effective vision
realign or screen with visual buffer where unsightly land uses lie within area of effective vision
37°
37°
area of effective vision

Figure G-9
Typical screen between roadway and unsightly adjacent land use.

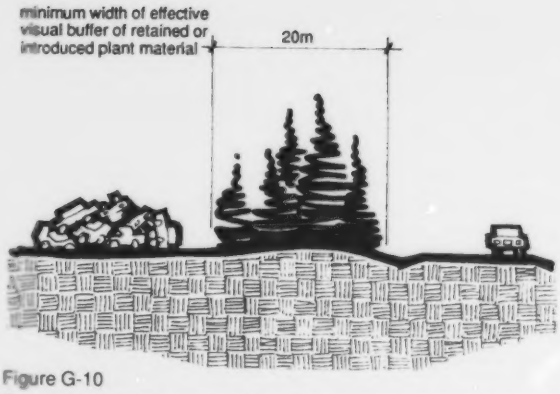


Figure G-10
For unsightly land uses, provide a 20m minimum planted buffer.

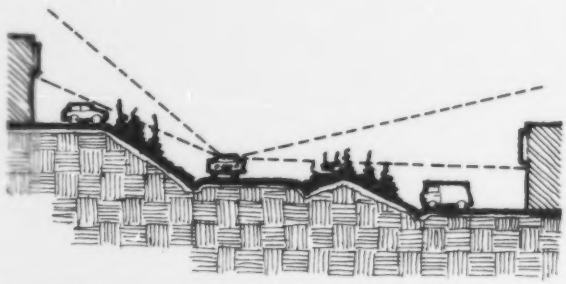


Figure G-11
For normal commercial business screen parking areas and yard operations.

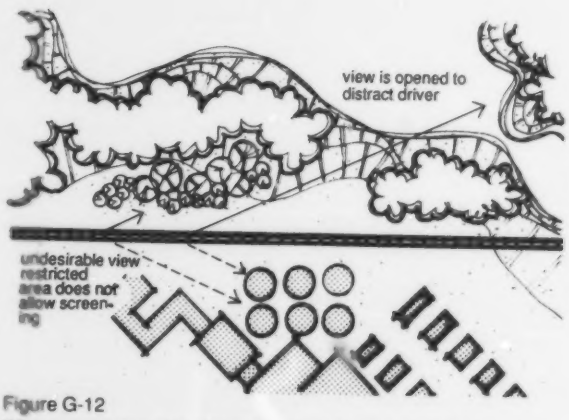


Figure G-12
Where screening of businesses cannot be accomplished, consider providing of alternate visual focus.

.5 Mitigate the effect of highway structures.

- Screen base of overpass support piers.
  - provide single species mass planting 1.5m minimum width in front of piers, extending for a length of 15m parallel to the roadway on both sides of pier.
- Consider screening at base and/or top of retaining structures.*
  - provide shrub borders of 1.5 minimum width, of a 3m maximum height, for walls **not exceeding** 3m high.
  - provide vines 1m on centre at base and/or top of wall for walls **exceeding** 3m height.
- Consider planting of traffic islands.
  - consider planting of traffic islands over 200m square and of 3m minimum width.*
  - plant shrubs, groundcovers, grasses, or wildflowers whose mature height does not exceed 600mm.

**refer to REVEGETATION (Operational Safety Distances) for height requirements within sight triangle and sight distances.*

**refer to REVEGETATION (Operational Safety Distances) for height and setback requirements.*

Figure G-13
Typical planting at the base of bridge and overpass support structures.

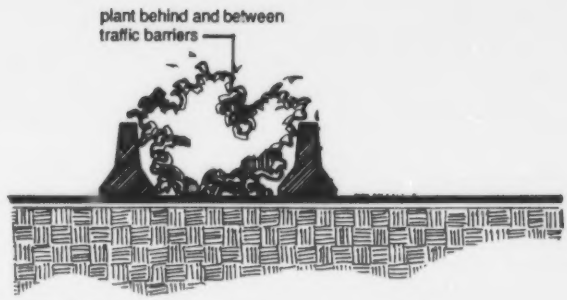


Figure G-14
Provide shrub planting between median traffic barriers.

Figure G-15
Provide for revegetation at the base and/or top of retaining structures.

Figure G-16
Provide planting within traffic islands and interchange loops.

4.0 Response to Views Toward the Road

Revegetation should enhance attractive views and screen negative views toward the road.

.1 Revegetation should consider the visual impact of roadway development on adjacent land use.

- Where highways are developed within 60m of residential property provide dense evergreen vegetation to a height required to screen the view of the roadway including the glare from headlights.
- Where roadways are developed adjacent to commercial interests revegetation should create a smooth transition between businesses and the highway.
- Specify plants which are responsive in character to adjacent residential or commercial planting.

Figure G-17
Revegetation developed in conjunction with adjacent landholders should provide a buffer between the highway and adjacent commercial or residential interests.

.2 Where highways are to be viewed from recreational areas revegetation should screen the view towards the highway.

- Where highways pass within 60m of recreation areas revegetation should be undertaken to screen the view to the highway.
- Where highways pass within 60m of wilderness recreation areas, revegetation should be undertaken with native vegetation to provide a complete visual screen.
- Where highway alignments pass near to lakes, rivers or waterbodies, ensure that revegetation is undertaken to preserve the visual integrity of the shoreline.
- Where highways pass through valleys or steep terrain ensure that revegetation is undertaken to restore cut and fill slopes.

5.0 Response to Natural Vegetation

Respond to the natural vegetation and habitat of the site.

.1 Recognize effects on natural vegetation remaining as a result of new road alignment.

- Assess potential "blow-down" of mature trees left without root support.
  - allow "blow-down" specimens to take a natural course where this presents no threat to pavement, safety setback or sight distances.
  - consider felling only that portion of "blow-down" specimens which threaten pavement, safety setback or sight distance. Preserve remainder of specimen as snag for wildlife habitat.
  - specify fast growing, soil stabilizing plant species for adjacent buffer areas to "blow-down" susceptible species.
  - where "blow-down" specimens are felled, retain topsoil and root systems to encourage root sprout regeneration.
  - where population of root sprouting trees is inadequate, specify pioneer tree species for adjacent buffer areas.

Figure G-18
Revegetation should consider and respond to the character of existing vegetation.

.2 Rehabilitate water edges disturbed by road alignment to improve and maintain aesthetic quality of water bodies.

- Replace stream-side trees to provide variety in enclosure along water's edge.
- Re-establish water edge shrubs, grasses, and reeds to integrate new shoreline with remaining undisturbed water edge.

Figure G-19
The crown vetch used as groundcover in this photograph blends with the surrounding context.

Figure G-20
Undulate the forest edge.

.3 Reflect natural vegetation habitat.

- Undulate the forest edge.
  - avoid straight lines within planting pattern and at planting edge.
- Fragment the forest edge by providing tree clumps as transition to forest edges, on cut and fill slopes, and as visual relief and landmarks in open areas.
  - provide a clump 10m minimum in diameter, maintaining a distance between forest and tree clump approximating the average distance occurring in natural vegetation.
  - provide a distance of 10m minimum where naturally occurring fragmentation of forest does not occur.
- Feather the forest edge.
  - reflect the natural gradation of forest edge (eg. from forbs and grasses, and shrubs, through pioneer trees, to mature forest). Plant any one area at 3m minimum width.
  - where slope exceeds 3:1 begin feathering of forest edge 1m beyond rounding of slope.

.4 Specify plant material which is hardy and fast growing, drought, salt, pollution and wind tolerant, requires low maintenance, and establishes quickly.

- Native plant material is generally preferable in rural conditions.
  - native plant material, typical to region, provides best selection of material to meet local conditions.
- Plant native plants to minimize maintenance.
  - plant in masses, limit number of species to five.

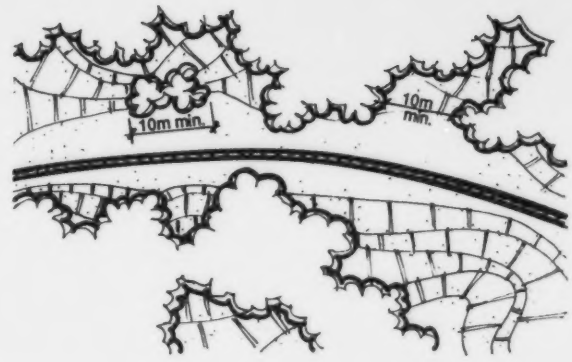


Figure G-21
Fragment the forest edge.

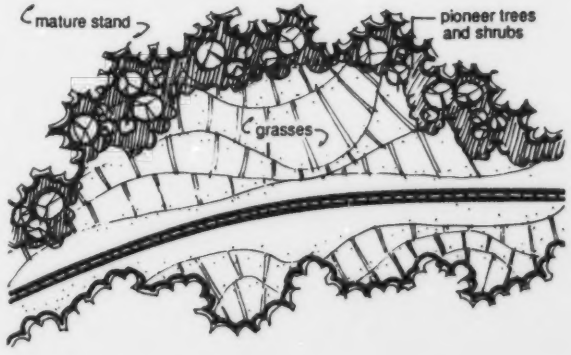


Figure G-22
Feather the forest edge.

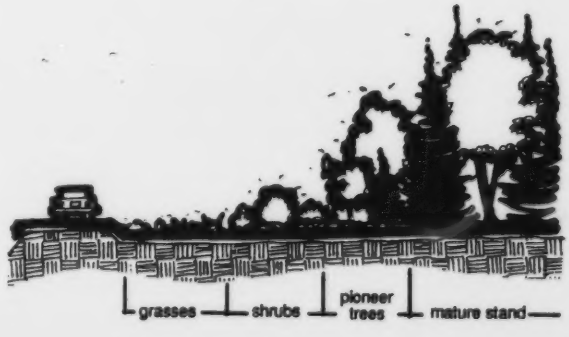


Figure G-23
Revegetation should create a transition from grasses through to mature trees.

6.0 Response to Erosion

Early establishment of vegetation on disturbed lands will minimize general surface erosion and assist in the stabilization of cut and fill slopes.

.1 Grasses are an adaptable, useful, and readily established groundcover, and are recommended as the first line of defense in controlling erosion caused by wind and surface runoff. A dense cover of grass also discourages invasion of undesirable weed species.

- Determine appropriate seed mixes based on soil conditions and local climate.
- Provide fertilizer suitable to site based on soil analysis.
- Consider the use of nurse crop grasses to assist in early establishment.
- Consider the use of nitrogen fixing legumes to develop more favourable growing conditions.
- Consider the inclusion of wildflower mixes to enhance the appearance and diversity of seeded areas.

.2 Specify appropriate methods to ensure the vigorous establishment of grass cover.

- Generally seed should be applied by hydroseeder.
- Specify the use of mulch where necessary for seed stability, or when seed cover is required and conditions are not ideal.
- Consider the use of soil tackifiers, and erosion control mats and netting for severe slope application or drainage courses.
- Use helicopters for seeding otherwise inaccessible sites.

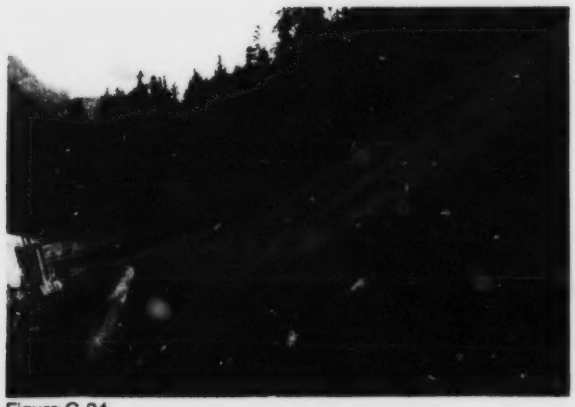


Figure G-24
A dense groundcover can reduce erosion and assist in the stabilization of cut and fill slopes.

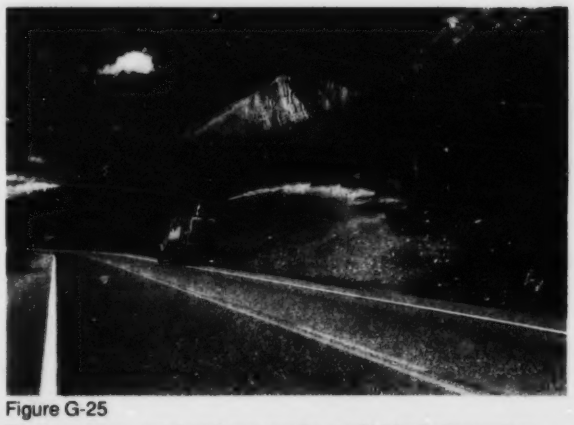


Figure G-25
For large areas seed mixtures can be applied by hydroseeders.

.3 Establish woody plants for long term erosion control.

- Install deep rooting trees and shrubs having good soil binding qualities.
- Use larger quantities of inexpensive seedling stock at closer spacings for rural locations.
- Use larger containerized material when advantageous visually or when larger root mass is required initially.
- Specify coarse growing, massing and suckering forms of plant material for slope stabilization.
- For developed locations, consider using plants having both erosion control and decorative characteristics.
- Anticipate requirements for speciality plant materials that may be of limited availability, eg. - native plant stock, and prepare custom growing contracts well in advance of the time of installation.

.4 Incorporate bio-technical slope stabilization techniques during construction of cut and fill slopes and along water courses.

- When appropriate, plan to provide additional mechanical stability to constructed slopes by using revegetation practices such as brush layering, fascines, and live staking using plants that are aggressive rooters.
- Locate sources of donor material for cutting in the general vicinity of the job site, and well in advance of the actual work.
- Specify requirements for supply of custom grown nursery stock applicable to this type of work well in advance.

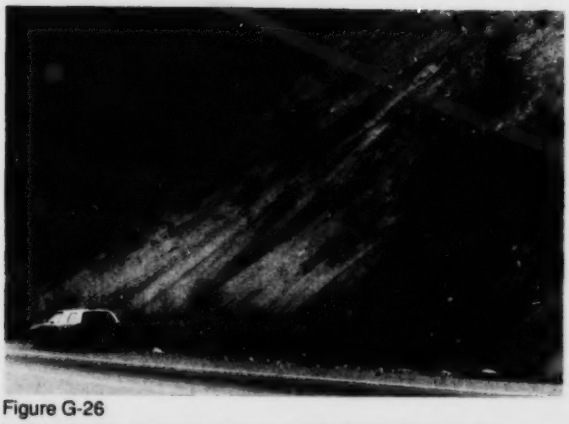


Figure G-26
In this situation grasses have not established. Deep rooting perennials are needed for this application.

Figure G-27
Additional slope stability is provided by using aggressively rooting plants and layering in plant material.

7.0 Response to Climatic Conditions

Revegetation should minimize rather than add to the effect of adverse climatic conditions.

.1 Revegetation should minimize potential for icing conditions in high risk areas.

- Avoid planting high growing coniferous trees in locations which would cast early morning shade on roadways in climates subject to black ice. Use of deciduous plants would be appropriate in these circumstances.

Figure G-28
In areas where snow drifting caused by high winds is an issue trees should be set back from the edge of pavement.

.2 Revegetation should minimize the potential for snow drifting in high risk areas.

- Set vegetation back from the road edge a distance of 7 to 8 times the height of a moderate (50%) vegetative screen (preferred).
- Set vegetation back from the road edge a distance of 11 to 12 times the height of a light (25%) vegetative screen.
- Set vegetation back from the road edge a distance of 13 to 14 times the height of a dense (75%) vegetative screen.

.3 Minimize the occurrence of sun glare.

- Feather revegetated edges to reduce abrupt transitions from full shade to full sun.

8.0 Response to Increased Traffic Volumes

Revegetation should minimize the negative impacts of increased traffic volumes.

.1 Minimize the visual impact of highway development.

- Ensure visual privacy of residences, where rear foundation line is within 60m of the highway pavement edge.
  - provide a dense evergreen screen of 3m minimum width, for the length of the respective property line, of a height necessary to screen the rear yard from the highway.
- Mitigate the visual impact of excessive fill earthworks or retaining walls visible to residences and tourist accommodation within 5km.
  - provide naturalized stands of evergreen trees, from the base of the slope and extending over slope, of a height necessary to screen the slope or wall face, where visible to communities within 5km. Mitigate the visual impact of excessive fill earthworks or retaining walls immediately adjacent to residential areas.
  - comprise buffer of both evergreen trees and deciduous shrubs.

.2 Screen to supplement noise abatement for the benefit of adjacent land uses.

Figure G-29
Vegetation can supplement other forms of noise abatement.

.3 Minimize headlight glare.

- Provide a screen between opposing directions of traffic, and between the highway and frontage roads.
  - provide a dense evergreen screen 3m minimum in width to a height of 1.5m above the finished elevation of the highway pavement.
  - where truck traffic is prevalent provide a dense evergreen screen 3m minimum in width to a height of 1.8m above the finished elevation of the highway pavement.
  - provide a minimum length of 60m and a maximum length equal to 5 seconds at highway design speed, broken by gaps not exceeding 10m.
  - plant on the outside of curves where the width of the median between opposing lanes is 20m or less.
  - plant in the median at the end of tangents where two alignments converge.

Figure G-30
Where roadways pass close by residential areas revegetation should provide a screen against headlight glare.

9.0 Response to Utility Services

Maintain adequate setbacks of both above and underground services.

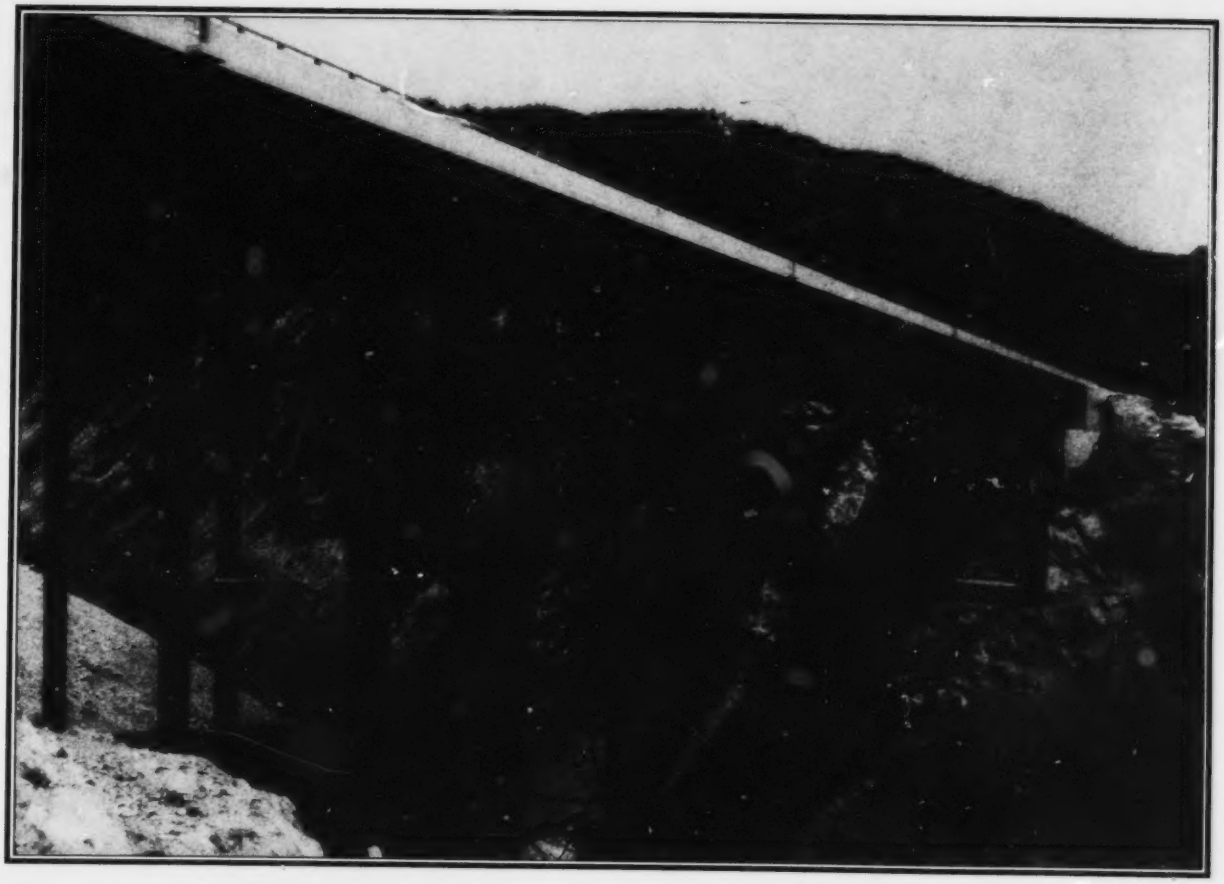
.1 Provide adequate setback of trees.

- Trees whose mature height will exceed trunk diameters of 100mm or larger must be setback as follows:

luminaire standards	6.0m
utility poles	3.0m
underground services	1.5m
catchbasins	2.0m
manholes	1.5m
valve boxes	1.5m
fire hydrants	3.0m

Figure G-31
Note setback distances from trees in this rural situation.

Figure G-32
Note setback distances from trees in this urban situation.



Roadway Structures

Roadway Structures

Introduction

Highway structures addressed in this section include the following:

- bridges
- overpasses
- avalanche sheds
- tunnels
- retaining walls
- traffic barriers
- bicycle routes
- curbs
- decorative paving
- safety handrail
- fencing

The design of the visible parts of these structures plays an important role in the aesthetic experience of the driver. This document does not address the aesthetics of general paving materials such as asphalt or concrete.

Recommended Practices

The following pages outline recommended practices concerning the aesthetic design of structures on highways in B.C., as summarized below:

1.0 Select appearance standards for structures in accordance with the Aesthetic Classification of the highway.

2.0 Integrate roadway structures with one another, with the adjacent landscape, and with the characteristics of the region in which they are placed.

3.0 Locate fill-reducing structures such as bridges or walls where aesthetic impacts of large cut/fill slopes are unacceptable.

4.0 Consider the proportion of the structure in relation to the size of the space in which it is situated.

5.0 All structures should be of a bold, simple form.

6.0 Select the colour of material finish to meet the aesthetic objectives of the structure.

7.0 Provide a textured finish to visible structures to avoid large blank faces.

8.0 Design structures to be of unified visual character within each space or structure.

9.0 Include accent elements in design of major highway structures.

10.0 Design roadway structures in concurrence with the guidelines for each type of structure.

1.0 Aesthetic Classification System

Select appearance standards for structures in accordance with the Aesthetic Classification of the highway.

Summary of Roadway Structure Guidelines by Aesthetic Classification

	Parkway	Tourway	Baseline Highway
Bridges, overpasses, avalanche sheds and tunnels	curvilinear form, colour to match natural setting, highly textured finish, highly detailed, "see-through" handrail, accents and decorative lighting.	curve and tangent form, colour to match natural setting, moderate use of texture, moderately detailed, "see-through" handrail, some accents and decorative lighting.	economical form, colour, texture, minimum spans, minimum detail, minimum accents, minimum lighting.
Retaining walls	curvilinear form, colour to match natural setting, heavily textured, highly detailed, custom designed handrail where required.	curve and tangent form, colour to match natural setting, moderately textured, moderately detailed, custom designed handrail where required.	angular form, economical colour and texture, minimum detailing, simple custom design handrail where required.
Traffic barriers	absolute minimum amount, "see-through" type preferred, custom colour and finish.	"see-through" type preferred in view areas, standard colour and finish.	minimum amount, economical type, colour and finish.
Safety handrail	custom design, material to reflect local theme, custom colour and finish.	custom design, economical material, custom finish.	basic design, economical material with basic finish.

Table H-1
Summary of Guidelines for Roadway Structures. This summary is based on definitions developed in Section B - Aesthetic Classification System. More detailed guidelines are outlined in Section H-10

2.0 Integration of Structures

Integrate roadway structures with one another, with the adjacent landscape, and with the characteristics of the region in which they are placed.

.1 Design roadway structures as an integrated system.

- Reduce the number of elements, where possible.
  - combine traffic barrier flares with bridge guardrail design
  - integrate bridge abutment walls with bridge design
  - combine wall and safety handrail design
  - combine light standard and wall design.

.2 Design structures to fit into the adjacent grades and landscape.

- Bridges and retaining walls should retain existing vegetation and adjacent earthworks.
  - top of wall should follow natural terrain to be retained, or reflect roll of natural terrain typical of the region. However, the natural terrain to be retained should not dictate a "roller-coaster" effect at the top of wall. Maintain stepping/sloping of wall up or down for a minimum length equal to 0.5 seconds at highway design speed. Constant sloped top of wall should change from up to down slope with 5m minimum radius.
  - at the end of wall the earthwork must meet the top of wall.
  - alternatively, if concrete traffic barrier must be placed at the end of the wall, the wall height should be equal and integrated flush with the traffic barrier. Material may be retained behind the traffic barrier.
  - wrap earthwork around the end of wall. For cribbing construction maintain a minimum 0.5m below top of wall elevation. For poured in place construction, taper wall to meet grade.
- Consider integration of lighting structures with adjacent terrain and vegetation.
  - attach lighting to cliff faces.
  - co-ordinate lighting location with retained or proposed planting.

.3 Consider the regional context of the structure.

- Incorporate regional materials, forms or symbols which make the highway structure more responsive to the local community.

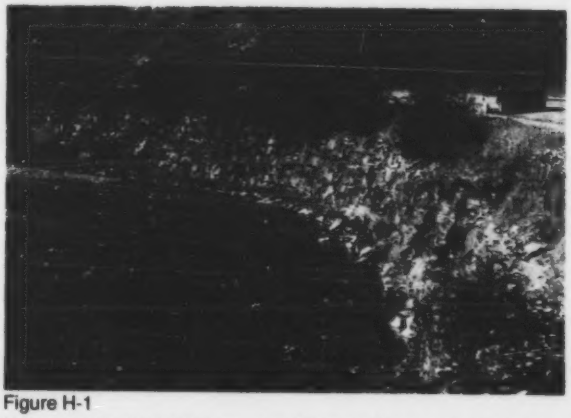


Figure H-1
Note good fit of retaining structure into its setting, and skilful use of drystone wall, seeded wildflower and trees.

Figure H-2
Select materials which may be indicative of the region in which the structure is placed.

3.0 Location of Structures

Locate fill-reducing structures such as bridges or walls where aesthetic impacts of large cut/fill slopes are unacceptable.

.1 In forested areas, where the height of a combined cut or fill bank exceeds 80% of the average height of the adjacent forest, consider retaining walls or viaducts to reduce the extent of cut and fill.

.2 Where highways cross significant valleys or ravines, consider bridges rather than cut/fill banks. When valleys are narrow, and economics allow, install bridges when:

- Fill banks would be visible to adjacent residential or recreation areas.
- Fill banks would not be screened by surrounding vegetation to views from the road.

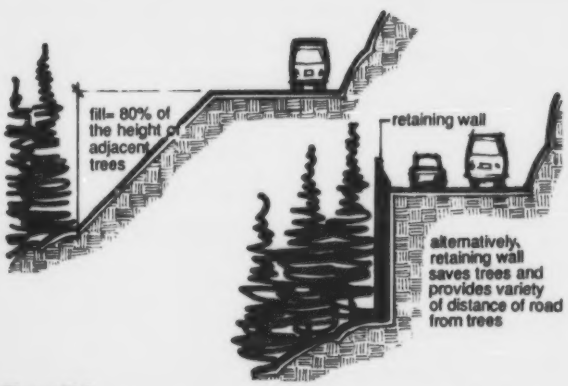

fill= 80% of the height of adjacent trees
retaining wall
alternatively, retaining wall saves trees and provides variety of distance of road from trees

Figure H-3
Consider retaining walls where fills exceed 80% of the height of adjacent vegetation.

Figure H-4
The wall in the background allows the vegetation downslope to be retained. The foreground shows the impact without the wall.

Figure H-5
Bridging streams whenever possible is preferable to installing culverts. Bridges maintain the continuity of the watercourse and help to minimize the impact of highway construction on natural systems.

4.0 Scale of Structures

Consider the proportion of the structure in relation to the size of the space in which it is situated.

.1 Avoid structures which will appear too large.

- Visual scale of structures varies depending on the size of space in which the structure is viewed.
  - the same size of structure will appear small in a huge space, and large in a small space. Therefore, consider the relationship of the size of the intended structure to the space in which it is to be situated.
- First, determine the size of the space in which the structure will be located. The 'space' will be the area in three dimensions (perspective) which can be seen looking down the centreline of the highway when viewing the structure at the closest possible point.
- Second, determine the visual area of the proposed structure, and compare it to the visual area of the space which can be seen. If the structure area exceeds 40% of the visual space, then it will feel too large. Look for ways to reduce the visual scale of the structure.

Figure H-6
The impact of this bridge was reduced by splitting the structure and allowing more light below.

5.0 Form of Structures

All structures should be of a bold, simple form.

.1 The overall shape of each structure should be a simple form, with a minimum of erratic or complex geometry.

- A combination of simple curves, straight lines, and square or rounded corners will be adequate for most structures.

.2 Avoid excessive use of angular, triangular or pointed forms - these should be limited to conditions where the objective is to attract the attention of the driver.

.3 Curvilinear or rounded structures will be 'softer' in appearance, whereas square or angular shapes appear more 'hard'. Generally, a softer appearance in rural highways will be more desirable.

Figure H-7
Curvilinear forms are softer and more in context with rural landscapes.

Figure H-8
Suspension bridges can have a dramatic and positive landscape impact.

6.0 Colour of Structures

Select the colour of material finish to meet the aesthetic objectives of the structure.

.1 Create a colour scheme for structures for a route in its entirety. Recognize the potential of colour to heighten visual interest.

.2 Blend structures into the background landscape.

- Respond to colour characteristics of the region.
  - dark khaki green or warm grey for forested backdrop.
  - medium khaki green or warm grey for cropland and wetland backdrop.
  - light khaki green or warm grey for grassland backdrop.

.3 Alternatively, contrast structural landmarks with background landscapes.

- Respond to the colour characteristics of the region.
  - deep primary red or natural concrete for forested backdrop.
  - terracotta or burnt sienna for cropland and wetland backdrop.
  - burnt sienna for grassland backdrop.
  - accent colours of apricot, dark blue, or grey blue may be used with discretion as accent colours.

.4 Finish colour may be gained by colour additives to concrete, or by paint on steel structures. Avoid painted concrete.*

**refer to section 10 of this chapter for practices on application of coloured finishes for aesthetic classifications of roads.*

Figure H-9
This large bridge structure is designed with a muted colour so that it blends with the hillside in the background.

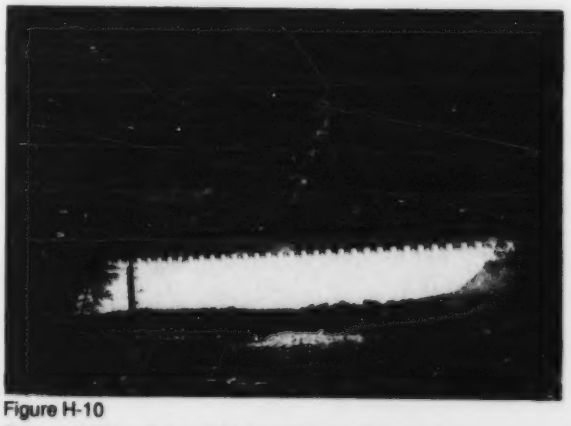


Figure H-10
This retaining wall has not taken into consideration the characteristics of the surrounding landscape and the strong white colour has a dramatically negative impact.

7.0 Texture of Structures

Provide a textured finish to visible structures to avoid large blank vertical surface areas.

.1 Provide textured finish to concrete structures where large vertical surface areas are visible to motorists and from adjacent land uses.

- Apply textured finish to concrete structures of 1.5m or more in shortest dimension.
  - maintain coarse textures on surfaces viewed from a distance.
  - maintain coarse and/or fine textures on surfaces subject to close inspection. Note that as highway design speeds increase toward 90 km/h, the ability to discern fine textured surfaces diminishes.
  - no texture on surfaces not exposed to view.

.2 Finish should respond to materials and texture typical of region.*

- Materials and textures include:
  - stone veneer
  - barnboard finish concrete
  - exposed aggregate concrete
  - bush hammered and/or ribbed concrete
  - sand blasted concrete

**refer to section 10 of this chapter for practices on applications of textures for aesthetic classifications of roads.*

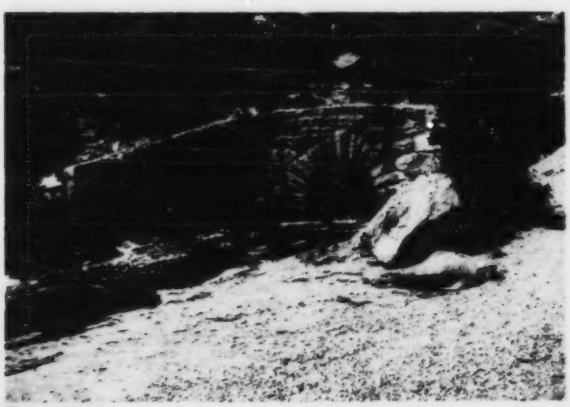


Figure H-11
A well designed culvert headwall - appropriate to a highly visible parkway site.

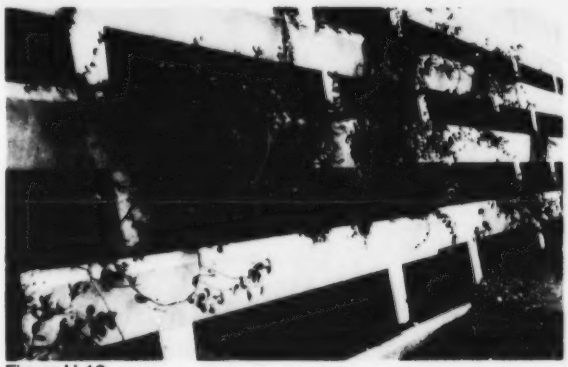


Figure H-12
This retaining structure is well textured with linear planting strips and vegetation. This scale of detail is appropriate when viewed at highway speeds.

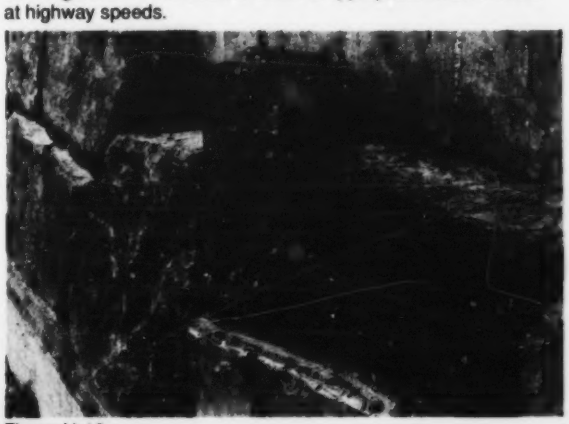


Figure H-13
Stone veneer in process. This would be appropriate on a Parkway project, or area of close public inspection.

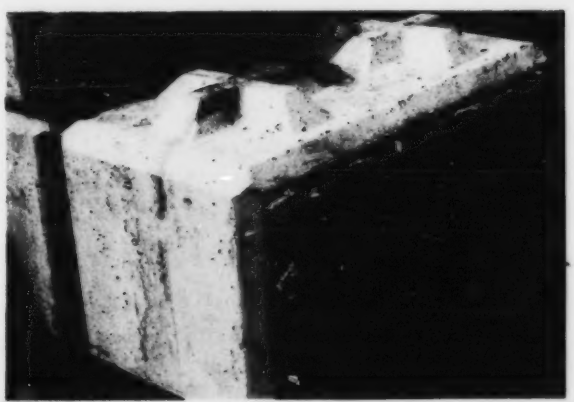


Figure H-14
This lock-block with stone finish would be appropriate for a tourway project.

8.0 Unity of Structures

Design structures to be of unified visual character within each space or structure.

.1 Design unity is gained by repetition of similar shapes and materials.

- Avoid designing structures which mix many different forms and materials.
- Choose a dominant form, and repeat this form throughout most of the structure, from the following:
  - curvilinear
  - curve and tangent
  - square
  - rectilinear
  - angular
  - free form
- Choose a dominant material, colour and texture, and repeat this combination throughout most of the structure, from the following:
  - exposed aggregate concrete, buff blend local aggregate, OR
  - unpainted weathering steel
- Design all custom elements within the same space using the same dominant form, material, colour and texture.

.2 Note the emphasis on choice of dominant form, material, colour and texture.

- A structure may still have a unified design and use more than one form and material, as long as the second form/material is limited to a subordinate role in the visual part of the structure (25% or less). These subordinate elements can be designed as accents.

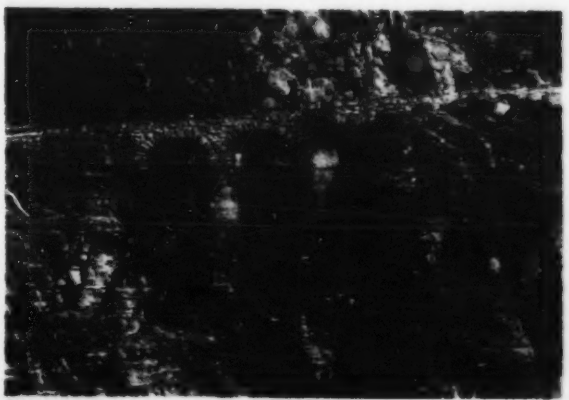


Figure H-15
A good example of repetition of form and texture.

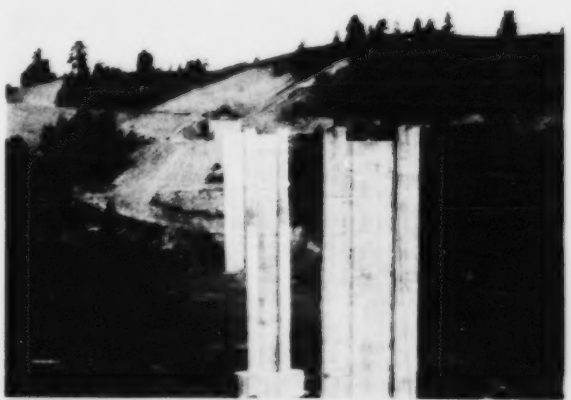


Figure H-16
This bridge structure will have the dominant vertical form of the piers repeated.

9.0 Accents

Include accent elements in design of major highway structures.

.1 Creation of accents involves the design of contrasting components of structures. These contrasting elements will draw the attention of the viewer, and 'accent' the overall design.

- 'Accents' should be limited in scale to no more than 25% of the structure.
- 'Accents' should be designed to be complementary to the structure, but not a total departure from the dominant form of the structure. Accents might include a change in one of:
  - colour - pick an interesting element and make it an accent colour.
  - form - accent an element by altering its shape to make it stand out - create a piece of sculpture.
  - texture - create a panel of different texture.
  - scale - make an element slightly larger to make it visually dominant.
- Avoid creating too many accents - more than one to two accents visible at a time will create visual confusion.
- Examples of accents include:
  - at bridges and overpasses - entrance pillars, infill panels among arches, handrail elements.
  - at tunnels and avalanche sheds - portals, escape exits
  - at retaining walls - pilasters, caps.

Figure H-17
The balustrade of this bridge has repeating accents. These aesthetic features can be adapted to the safety requirements of modern bridges.

10.0 Guidelines

Design roadway structures in concurrence with the guidelines for various types of structure below.

.1 Bridges, Overpasses, Avalanche Sheds and Tunnels.

- As large scale and custom designed elements, bridges and overpasses, avalanche sheds and tunnels should be designed as pieces of sculpture. Major attention should be given to aesthetics, as these elements will be the most memorable structures on the highway.
- If structures of a similar nature are seen at the same time, they should be designed as matching sets, eg.
  - parallel bridges on divided highways.
  - overpasses seen at the same time.
  - tunnel portals or avalanche sheds seen at the same time.
- Bridge designs should be bold, simple, and unified:
  - minimize the number of spans and columns.
  - where possible create odd numbers of spans (1, 3, 5) and make the central span larger than the remainder.
  - avoid random or complex variation in lengths of spans.
  - 'leap' the chasm.
- Bridge handrails and traffic barriers should receive special design attention:
  - handrail/traffic barriers should be as see-through as possible when a view can be gained from the structure.
  - as vertical elements, handrails and traffic barriers will be the most visible elements on the bridge.
  - the design of traffic barriers on a bridge should provide visual clues that the motorist is crossing a bridge - some modern designs for safety have created such continuity with the road that the bridge is not evident to the driver.

Figure H-18
Unlike this example, parallel structures should be designed as matching sets, even if constructed in different phases.

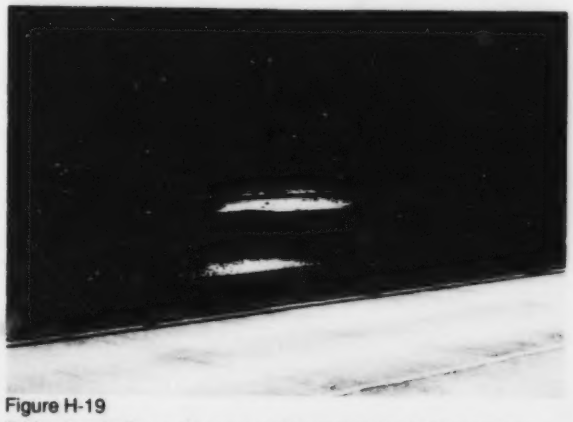


Figure H-19
Bridge handrails are the most visible part of the bridge structure and should receive special design attention.

- Bridge abutments should be designed in conjunction with adjacent grades, landscape and structures:
  - provide 2:1 side slopes maximum, or retaining wall at abutments.
  - ensure that abutment walls taper into adjacent grades - do not allow vertical jumps exceeding 0.5m at ends of abutment walls.
  - allow for revegetation of bridge abutment slopes, and for retention of vegetation close in to the bridge abutments.
  - incorporate traffic barrier flares into design of bridge approach and bridge traffic barriers.
- Bridge slope protection should be finished to a maintainable condition:
  - aprons which are visible to traffic or adjacent uses should be hard surfaced.
  - aprons not visible may be graded to a 2:1 maximum slope and revegetated with drought tolerant species.
  - blend apron grades into adjacent slopes and complete rounding at top and bottom of apron slope, if not paved.
- Minimize disturbance to the valley or site during construction:
  - plan designated construction routes and construction river crossings in areas to be out of view after construction.
  - retain natural trees and vegetation under the bridge structure where possible.
  - provide for complete revegetation or rehabilitation of areas adjacent to bridges disturbed by construction.
  - in steep slope areas, use opportunities to create or expose waterfalls above the highway.
- Provide recreation amenities associated with bridge crossings or attractive structures:
  - provide a roadside pullout at a vantage point from which to view the structure, or close to the structure to allow access to the abutment of the structure and the associated features.
  - provide trail access from a roadside pullout to the water feature/valley which the structure crosses.
  - provide walkway/bikeway access across the bridge structure.

Figure H-20
Example of a rural bridge slope finished to allow ease of maintenance.

Figure H-21
Example of a more urban bridge abutment.

Figure H-22
Provide pullouts or other recreation amenities associated with beautiful structures.

- Design accent features at the entrance and mid-point of major structures:
  - gateposts or similar features can mark the entrance to major bridges.
  - arches can provide spectacular entrances to tunnels or avalanche sheds.

- Lighting of major structures can take innovative forms:
  - incorporate lighting designs to be integral with the design of the structure - avoid add-on lighting standards.
  - ensure that fixtures on structures are low glare - especially if close to the driver's field of vision.
  - consider accent lighting of structures, either by uplighting or by suspended lights, to create nighttime landmarks.

Guidelines by Aesthetic Classification for Bridges, Overpasses, Avalanche Sheds and Tunnels

	Parkway	Tourway	Baseline Highway
Form	curvilinear form, with arch spans or innovative structures	curve and tangent form, with curved flares at column tops, curved skirts	simple structural form, minimum odd number of spans
Colour (may be accent colour if landmark is desired)	colour to match natural setting, eg. coloured concrete or painted metal	same as for Parkway	economical colour of construction material eg. natural concrete
Texture	highly textured, eg. stone, barnboard concrete, ribbed or bush hammered finish, or other rustification	medium texture, eg. exposed aggregate concrete, sand blasted concrete	economical texture, eg. rubbed finish concrete
Level of Detailing	highly detailed, small repeating panels	moderately detailed, some repeating patterns	simple articulation, little detail
Accents	design accents to entrances and midspan	same as for Parkway, but smaller scale.	minimum design accents
Handrail/Traffic Barrier	custom design, highly detailed, "see-through"	custom design, moderately detailed, semi-open.	"see-through" or solid, economical
Bridge Slope Protection	highly textured finish, e.g. rubble or cobble paving	moderately textured finish, e.g. exposed aggregate concrete, precast pavers.	economical paved finish or revegetation of non-visible areas
Recreation amenities	trail access to local features, pullout to access trail and view structure	same as for Parkway	no special recreation amenities unless conditions warrant
Decorative Lighting	provide decorative lighting of visible structure	same as for Parkway	economical or no decorative lighting

Table H-2
Guidelines by Aesthetic Classification for Bridges, Overpasses, Avalanche Sheds and Tunnels

.2 Retaining Walls

- The scale of retaining walls should not be out of proportion with the size of the cleared space of the roadway:
  - wall height should not exceed the dimension of the right of way width.
  - walls over 3m height should be broken down into tiers whenever possible.
  - wall tiers or pockets should be revegetated to reduce the visual scale of the wall.
- Walls over 1.2 m in height should not exceed a length which would expose the driver to a continuous section of wall for over 15 seconds while driving at the design speed.
- The location of retaining walls should not detract from the aesthetics of the highway:
  - walls should not dominate the area of effective vision of the driver.
  - attempt to limit walls to the inside radius of curves.
  - realign the road and place the retaining wall on the downslope side: if height or length of wall is excessive, or if existing vegetation must be kept close to the highway edge to mask the hillside scar.
- Integrate walls with other structures, eg.
  - use wall for mounting of light fixtures.
  - extend walls to meet overpasses and bridge abutments.
  - extend walls to act as guardrail or handrail.
- Custom design walls to suit the site:
  - elevation of the wall should follow the grade to be retained as a simple ascent and descent, following the natural grade of the land. Avoid arbitrary rectangular or angular wall elevations which do not relate to the slope to be retained.
  - taper ends of walls to meet adjacent slopes without vertical drops, by either:
  - tapering the wall into the ground, or raising the grade at the end of the wall, by creating a berm in front of the wall.
  - curve walls where required by roadway alignment, or to follow adjacent landforms.

Figure H-23
When possible, locate retaining walls downslope from the highway, to reduce visual impacts from the highway.

Figure H-24
Viewed from the road this retaining structure is completely hidden.

Figure H-25
An example of a retaining structure using locally available materials.

- Provide for drainage and landscape at the top and bottom of the wall:
  - backfill slopes should not exceed 2:1 for revegetation.
  - drainage at base of upslope walls should be piped, to avoid the appearance of a ditch at the base of the wall.
  - allow for landscape installation at the top and bottom of the wall, to reduce the visual height of the wall.

- Avoid use of handrail on walls except where necessitated by public access to the top of the wall:
  - consider creating a handrail/balustrade by vertically extending the wall structure.
  - design handrails in concert with the wall using similar or complementary materials. Avoid add-on standard handrail details, as these will look out of place on top of a wall.

- Design guidelines by Aesthetic Classification for retaining walls are shown in Table H-3.

Guidelines by Aesthetic Classification for Retaining Walls

	Parkway	Tourway	Baseline Highway
Form	curvilinear form, both horizontal and vertical.	curve and tangent form, both horizontal and vertical.	angular form.
Colour	match to natural setting e.g. coloured concrete.	same	economical colour of material e.g. natural concrete.
Texture	highly textured, e.g. stone, barnboard concrete, ribbed or bushammered concrete, or other rustification. Bin wall with textured concrete veneer.	moderately textured, e.g. sand blasted concrete, exposed aggregate concrete. Bin wall with textured concrete veneer.	economical texture, e.g. rubbed finish concrete, galvanized bin wall.
Level of Detailing	highly detailed.	moderately detailed.	simple detailing.
Accents	includes accent pilasters, arches and cap.	moderate use of accents.	no use of accents.
Handrail	custom design, highly decorative.	custom design, moderately decorative.	simple design, paint finish minimum.

Table H-3
Guidelines by Aesthetic Classification for Retaining Walls

.3 Traffic Barriers

- Keep use of traffic barriers to a minimum required for safety.
  - decrease degree of side slope to reduce need for barrier.
  - increase width of median to decrease need for median barrier.
  - avoid columns near roadside or in medians to reduce need for traffic barrier.
- Use the lowest height of traffic barrier required for safety.
  - consider creation of depressed medians and shoulder to reduce the visual height of traffic barriers.
- Minimize the use of yellow paint at concrete traffic barrier ends :
  - attach traffic barrier reflective sign to traffic barrier.
  - consider accent band of reflective vinyl at ends.
  - consider integral coloured concrete.
  - where paint is necessary, ensure that its application standard is high, and that it is maintained regularly to avoid a peeling and unkempt condition.

Figure H-27
Avoid the use of paint on concrete traffic barriers

Figure H-26
The provision of a wide and varied median could have avoided the requirement for a continuous traffic barrier.

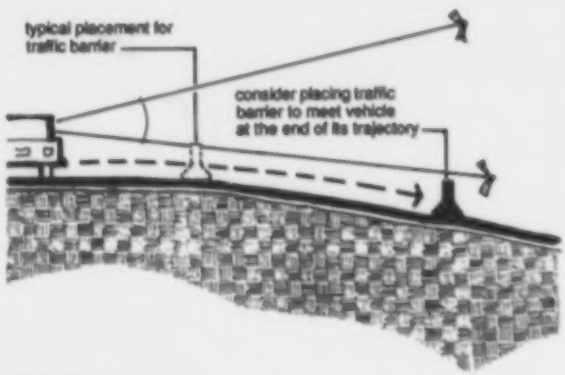


Figure H-28
Locate traffic barriers to minimize their visual predominance.

- Consider installation of reflectors to lift holes, rather than at junctures.
- Select traffic barrier types with greater "see-through" characteristics for low speed, low volume highways with scenic views below the elevation of the highway. Consider use of:
  - three cable/wood post traffic barrier.
  - W-beam blocked, wood post traffic barrier.
  - box beam, steel post traffic barrier.
- Consider maintenance of roadside under traffic barriers.
  - pave area under and within 300 mm horizontal of traffic barriers to eliminate need to mow at traffic barriers.

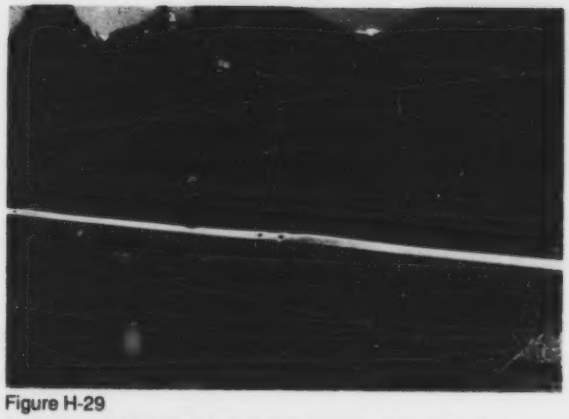


Figure H-29
Consider installation of "see-through" forms of traffic barrier where views below the highway are frequent.

Guidelines by Aesthetic Classification for Traffic Barriers

	Parkway	Tourway	Baseline Highway
Amount	absolute minimum required for safety at low design speed	minimum required	minimum required
Type	three cable or W-beam preferred	three cable, W-beam or box-beam preferred	same preferred at areas with views, otherwise concrete acceptable
Colour/texture	cortan steel W-beam, sandblasted coloured concrete finish if applicable	same as for Parkway	economical finish - form finish concrete, galvanized steel

Table H-4
Guidelines by Aesthetic Classification for Traffic Barriers.

.4 Bicycle Routes

- Provide safe and convenient bicycle access to highways and incorporate bicycle route system into proposals for comprehensive bicycle route systems.
  - bicycle routes should allow for easy access without requiring cyclists to stop or dismount.
  - bicycle routes should be developed to provide direct access to and from desirable destinations including: shopping areas, recreational facilities, and residential areas.
  - encourage continuity between highway bicycle routes and adjacent portions of bicycle routes.
  - provide the most direct route possible especially where non-recreational cycling is anticipated.

Figure H-30
Bicycle routes can be developed as an integral part of the highway.

Figure H-31
Bicycle routes can be constructed as separate alignments where the conditions and level of use warrant.

- Bicycle route surfaces should be developed to a high quality.
  - surface quality should be smooth and consistent as required by narrow, high pressure bicycle tires.
  - where bicycle routes are separate from roadways, eg. at intersections and railway crossings surface quality should be maintained to create a continuous, uninterrupted traffic flow.
  - bicycle routes should avoid abrupt changes in vertical and horizontal alignment which can be inconvenient or dangerous.
- Bicycle routes should be developed to provide a high level of visual interest.
  - the intense scrutiny of roadsides by cyclists support the requirement for careful clearing and grubbing, and revegetation practices.*
  - avoid bicycle routes adjacent to deep ditches and other unsightly roadside conditions.**
  - bicycle routes should be signed so that direction of travel is easily understandable to cyclists.
  - signage should be such that motorists are aware of the potential presence of cyclists.

refer to CLEARING AND GRUBBING, and REVEGETATION for creating natural forest edges

**refer to EARTHWORKS to create safe relationship to ditches etc.*

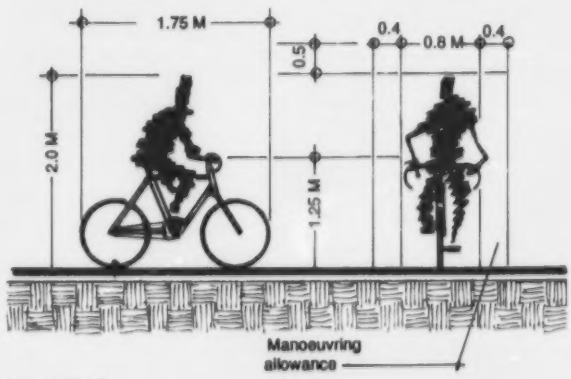


Figure H-32
The dimensions of a cyclist.

- Bicycle routes can be developed in different formats and should be implemented as appropriate for each circumstance.
  - for Tourway and Parkway highway development consideration should be given to separate bikepath alignments if policy and funding permits.
  - for baseline highway developments where shoulder bicycle routes are most appropriate consider providing intermittent sections of separate bikepath alignments to create visual interest.

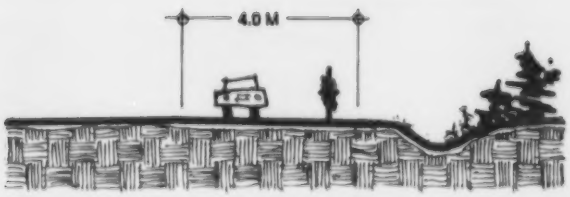


Figure H-33
With the Shared Roadway alignment motorists and bicyclists share the same lanes.

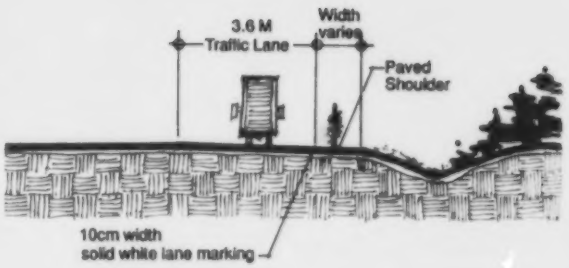


Figure H-34
A smooth paved shoulder along rural highways can be signed as a bicycle route.

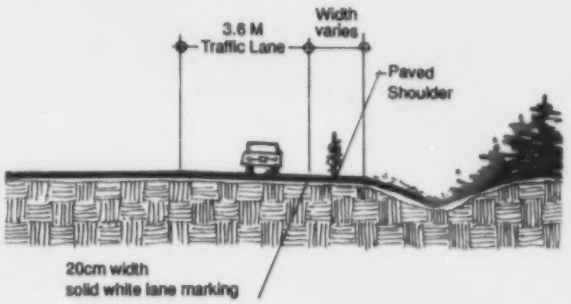


Figure H-35
Bike lanes have preferential use for cyclists.

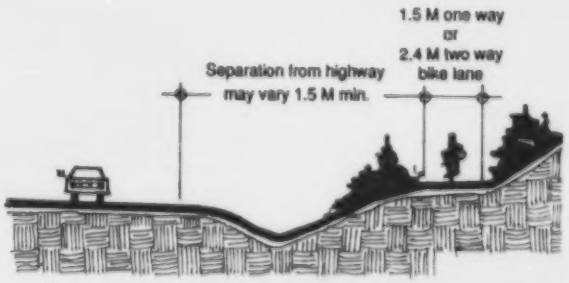


Figure H-36
Bike paths with separate alignment are preferable in Tourway and Parkway situations.

.5 Curbs

- Provide curbs where required to keep traffic out of landscape areas.
  - at all parking areas.
  - at feature landscape areas.
- Use concrete curbs where affordable. Do not use asphalt curb where it is likely to be bruised or broken by vehicle impact.
  - in parking areas.
  - high traffic areas.
  - narrow shoulder areas.
- Minimize use of paint on curbing:
  - develop alternate colouring techniques such as integral colour to concrete and reflective vinyl tape.
  - upgrade standards of paint design, application and longevity.
  - increase maintenance standard to avoid chipping, peeling paint on curbing.

Figure H-37
Minimize the use of paint on curbs, or develop higher maintenance standards to minimize peeling, cracking condition.

.6 Decorative Paving

- Install decorative paving on median or roadside areas
  - where pedestrian and vehicular traffic is to be discouraged.
  - where widths of medians are less than 2.0m, and therefore too narrow for planting.
- Decorative paving should be set in mortar or designed with joints which impede the growth of weeds.
  - keep top of decorative paving flush with top of curb, and tightly jointed, to avoid collection of sand/water and subsequent weed growth.
- Create a coarse textured finish to decorative paving:
  - to be visible to passing motorists.
  - to help disguise small scale litter.
  - to show through sand/soil deposits.

Figure H-38
Decorative paving should be installed in traffic islands and medians where space is insufficient to allow planting.

.7 Safety Handrail

- Design handrails for bridges and walls as an integral part of the design of the bridge or wall, not as a standard detail.
- Minimize the use of safety handrail, using it only when:
  - pedestrians may be adjacent to the drop.
  - and the drop is 2:1 or steeper, with the height of drop exceeding 2m.
  - or the drop is steeper than 1.5 :1, and exceeds a height of 450mm.
- Basic design requirements for safety handrail above a slope 2:1 or steeper if height of drop exceeds 2m are:

height	1067mm
space between horizontal members	450mm
space between vertical members with continuous horizontal bars	3000mm
space between vertical members without horizontal bars	100mm

- Consider custom design of handrail to respond to its proposed site and region.
  - use materials or design form prevalent in the region or locale e.g. timber, nautical theme, marsh theme.
- Basic design requirements for safety handrail above a slope or vertical drop exceeding 1.5:1 are as per National Building Code, which requires that:
  - handrails be non-climbable
  - and that a 100mm diameter spherical object will not pass through the handrail.
- Handrail requirements for physically challenged in roadside facilities, are in addition to the above.
- Design handrails to be pleasant to the touch.
  - top rail should be smooth, rounded, and free of slivers or vertical interruptions to a handhold.
  - top rail should have rounded corners at end of railing. Avoid angular changes in direction on the top rail.
  - avoid use of chain link fencing for handrails
- Design guidelines by Aesthetic Classification for safety handrails are shown in Table H-5.

Guidelines by Aesthetic Classification for Safety Handrails

	Parkway	Tourway	Baseline Highway
Form	custom design	custom design	simple design, standard adapted to conditions and adjacent structures
Material	timber, metal, or alternate decorative materials	same as for Parkway	metal pipe rail, radius ends
Colour	custom colour or finish	custom colour	painted, neutral colour to blend with adjacent natural setting

Table H-5
Guidelines by Aesthetic Classification for Safety Handrails

.8 Fencing

- Wood post and woven wire fencing are adequate for all rural areas of the province.
- Wildlife fencing should be a higher version of livestock fencing, with wood posts and woven wire.
- Avoid the use of chain link fencing in rural areas.
- In wooded areas, install fencing back from the edge of the woods. Allow feathering, undulation and fragmentation of the forest edge to occur around the fenceline, so that the fence is sometimes within the woods and sometimes at the edge of the woods.
- Locate fences to the outside of cut or fill slopes wherever possible, and avoid silhouetting the fence against the sky or against a view.
  - do not locate fence at top of fill bank.
  - set back fence minimum 3m from top of cut bank.

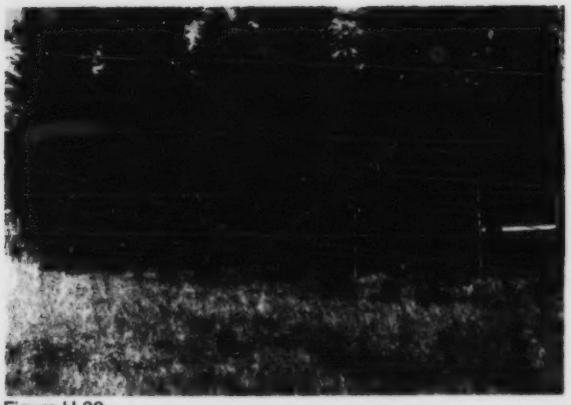


Figure H-39
Wood post and agricultural style woven wire are appropriate for wildlife fencing. Note that fencing is routed through the trees in some cases.

.9 Signs

- Provide adequate illumination for night viewing.
  - preferably all signs should be fully reflectorized
  - signs not adequately visible by fluorescence should be lit by attached overhead light, matching the length, scale and colour of the sign.
- Limit the number of Ministry signs.
  - provide signs only for directional, and safety purposes of the driver. Avoid all other signs which apply to jurisdictional and electoral purposes. This information can be supplied to inquiring parties through government offices and maps.
  - commensurate to the visual absorption capacity of the driver at highway design speed, consolidate sign messages onto one board wherever possible. Examples would be adding tonnage limits and/or highway demarcation number onto directional/distance signs.
  - commensurate to the visual absorption capacity of driver at highway design speed, consolidate several boards onto a single support structure wherever possible.
  - encourage the existing program of consolidating private businesses' information onto Ministry "blue signs". Ensure that subsequent to installation of "blue signs", that all signs to be replaced are removed.
  - encourage all service club and local information signs to be consolidated onto standard information boards at municipal entrances.These information signs could be separate from custom designed community entrance signs which are provided by the community to identify the community and welcome visitors.
  - encourage private business associations, such as those related to Bed and Breakfast operations to develop standard signing.
- Provide clear and visually clean information.
  - develop and consistently use symbols to designate food, fuel, rest facilities, accommodation, telephone, transportation services, tourist attractions, recreational facilities, hospitals, police and information.
  - develop and consistently use symbols to designate intended tourist routes.

- implement and consistently use internationally recognized symbols to designate directional and safety instructions, instead of verbiage.
- verbiage shall be minimized and utilize a system of upper and lower case letters wherever possible.
- provide symbol information on rest area advance signs about specific facilities available such as picnic, tourist information, trash receptacle, telephone, toilet, camping and recreational opportunities, and of natural attractions available such as waterfalls and viewpoints.
- provide information on rest areas advance signs about distance to next closest rest area on same route.

- Provide a clean and solid looking silhouette with the sign.
  - support structure of sign should consist of galvanized or I-bar post, or wood post. In Parkway or Tourway situations, a special signage system might be developed for the route.
  - support structure should consist of two posts or I-bars for all signs wider than typical stop sign.
  - where two or more sign boards are attached to a support structure all signs should be equal in length.
  - where sign support structures require pier footings, the top of the piers should be flush with the grade.

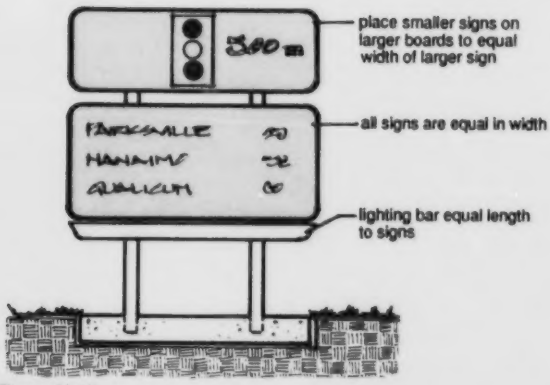

place smaller signs on larger boards to equal width of larger sign
all signs are equal in width
lighting bar equal length to signs

Figure H-40
Consolidate several signs onto a single support structure. Signs and sign lighting enclosures should be of equal length to create a clean silhouette. Piers should be flush with grade.

- Provide and coordinate a consistent format and series of size types, for all Ministry signs.
  - consider that signs be broken down into two or three categories based on width, eg. one category of signs carrying one symbol such as stop signs, and two categories of signs carrying text and/or symbols such as directional and "blue" signs.
  - consider that all signs stand at consistent distances from the pavement edge, and at consistent heights.

- Minimize the obstruction of views or visual impact with signs.
  - avoid locating signs where views or clearings exist along the roadside. All unnecessary signage, earmarked for that specific location should be located at the next most convenient location further along the highway.
  - wherever signs must be located in conflict with views or clearings along the roadside, provide background planting typical to the vegetation of the region.

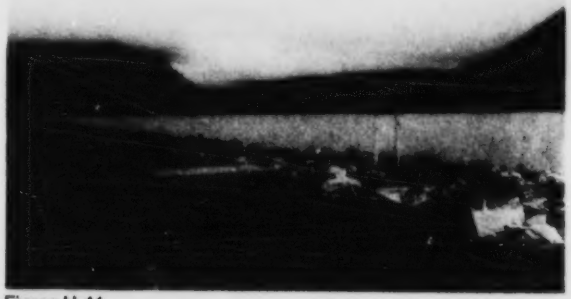


Figure H-41
Avoid locating signs where they obstruct views.

Roadside Facilities

Roadside Facilities

Introduction

Highway roadside facilities addressed in this section include the following:

- safety rest areas
- tourist information centres
- picnic areas
- scenic lookouts
- pullouts
- cultural / historic sites
- weigh scales
- toll booths

The development of Safety Rest Areas have been a part of highway design in North America since the 1920's with a major emphasis on implementation related to the US Interstate Highway system from the 1960's to date.

Rest areas perform a valuable function related to highway safety. By offering a respite from the monotony and fatigue of long distance driving, rest areas encourage motorists to stop briefly, and to return to the road as safer drivers.

Well designed rest areas provide a good image of the Ministry, and of the province of B.C.

Where new highways are being developed in B.C. there is a great opportunity for the creation of rest areas. Along existing highway routes, there is also the opportunity to redevelop and expand existing rest areas.

The function of safety rest areas within this highway system might include: providing a rest from driving, emergency stops, travel information, interpretive information, restrooms, telephones, picnic facilities, recreational areas, and access to private concessions, such as service stations or lodging.

There is an opportunity with the new emphasis on transportation in the province, to bring B.C. rest areas up to state of the art standards.

Recommended Practices

The following pages outline recommended practices concerning the aesthetic design of roadside facilities for highways in B.C., as summarized below:

1.0 A Provincial Roadside Facility Program is in place including a Provincial Master Development Plan, and Regional/District Implementation Plan for Roadside Facilities.

2.0 Roadside Facilities will be identified as one of the following: Safety Rest Area - Class A, B, or C, or Pullout.

3.0 Select the spacing and appearance standards for roadside facilities in accordance with the Aesthetic Classification of the highway.

4.0 Prepare a Roadside Facility Spacing Plan which identifies the approximate distribution of roadside facilities along each highway route.

5.0 Complete a site selection process which incorporates roadside facility programming, conceptual plans of alternate sites, and objective means of site selection.

6.0 Design and develop roadside facilities with attention to detail appropriate to the close inspection which the facility will receive.

7.0 Regional Managers are encouraged to appoint the appropriate specialist disciplines to the planing and design of roadside facilities.

8.0 Summary of Roadside Facility Planning and Design Method.

1.0 Provincial Roadside Facility Program

A Provincial Roadside Facility Program is in place, including a Provincial Master Development Plan, and Regional/District Implementation Plan for Roadside Facilities.

.1 The Provincial Roadside Facility Master Development Plan identifies the following:

- Current inventory of facilities.
- A spacing plan for roadside facilities, including recommendations for additions, deletions, and upgrading of safety rest areas.
- Design guidelines and standards for features common to roadside facilities.

.2 Regional and District Implementation Programs include:

- A review of potential roadside facility sites.
- A site selection process, which will include preliminary conceptual design for alternate sites, and a documentation of rationale for selection of preferred sites.
- Capital cost estimates for construction of roadside facilities, and recommended priorities and time lines for financing and construction.

.3 On-going coordination of provincial and local plans will be to create a comprehensive and evolving Provincial Roadside Facility Program.

.4 Planning for location and site selection of roadside facilities for new highways will be performed concurrently with alignment design.

2.0 Definitions of Roadside Facility Types

Identify proposed roadside facilities as one of Safety Rest Area - Class A, B, or C, or Pullout as defined below.

.1 Safety Rest Areas

Safety Rest Areas in B.C. will be one of three classes as outlined below:

Safety Rest Area - Class A

Class A Safety Rest Areas will be major full service facilities on major tourist routes in the province. Features will include:

- permanent building
- flush toilet facilities and wash basins
- minimum 2 men's, 3 women's units
- various other rest area amenities

Safety Rest Area - Class B

Class B Safety Rest Areas will be smaller facilities, including:

- small toilet building(s)
- one or two units minimum for men/women.
- toilets to be water or chemical flush type.
- other amenities as site allows

Safety Rest Area - Class C

Class C Safety Rest Areas will have a minimum level of facilities in remote, low use areas only, including:

- Pit toilets, or chemical vault privies
- no potable water supply
- litter receptacles
- minimum of other amenities

.2 Pullouts

Pullouts are widenings of the road shoulder to allow short term stops for up to three vehicles per pullout. Pullouts may often be at minor views or points of interest. Facilities at pullouts may include:

- information or interpretive signage
- litter receptacles
- safety handrails
- pullouts do not have toilet facilities

.1 Safety Rest Area - Class A

- Class A Safety Rest areas are major facilities to provide safe refuge from the monotony of driving, including services such as:
  - deceleration/acceleration lanes
  - separate car and truck parking areas
  - flush toilets and service building, 2 men's and 3 women's units minimum
  - picnic area
  - walkway system
  - pet exercise area
  - lighting, telephone and supporting utilities
  - rest areas may also include functions of viewpoint/information areas

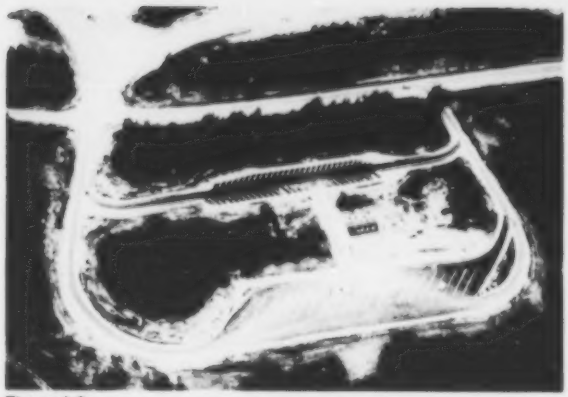


Figure I-2
Class A Safety Rest Area.

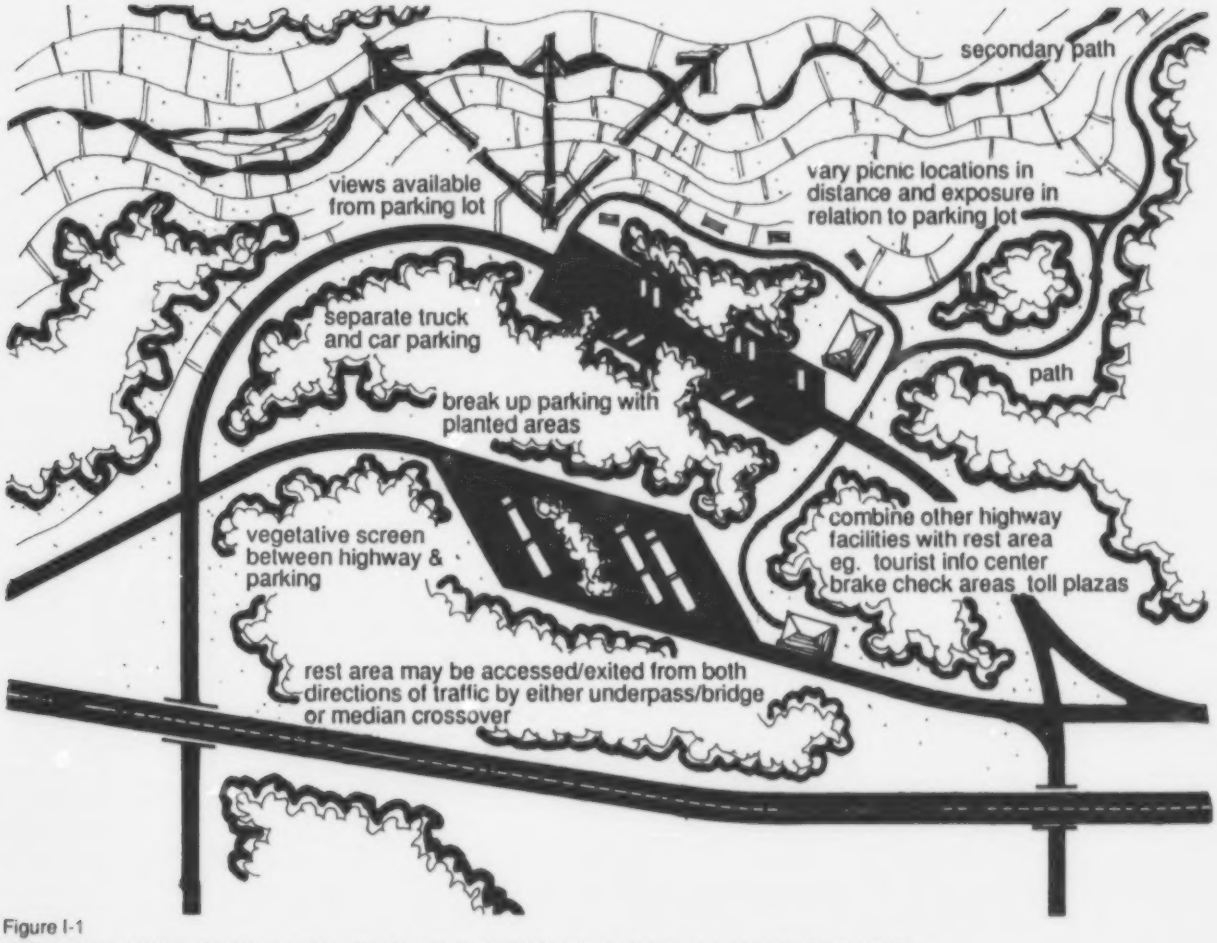

secondary path
views available from parking lot
vary picnic locations in distance and exposure in relation to parking lot
separate truck and car parking
path
break up parking with planted areas
vegetative screen between highway & parking
combine other highway facilities with rest area eg. tourist info center brake check areas toll plazas
rest area may be accessed/exited from both directions of traffic by either underpass/bridge or median crossover

Figure I-1
Typical Class A Safety Rest Area Schematic Plan. Note: Each Rest Area plan must respond to the local site.

.2 Safety Rest Area - Class B

- Class B Safety Rest Areas are intermediate size facilities to provide safe access to significant viewpoints, interpretive or tourist information, including services such as:
  - deceleration/acceleration lanes
  - combined car/oversize vehicle parking
  - small, usually standard washroom buildings containing water or chemical flush toilets, minimum 1 unit each for men/women
  - walkway system
  - viewpoint area and associated signage, and/or interpretive display, and/or tourist information signage
  - small picnic area, only if potable water and wash basins are available
  - other optional facilties such as viewing decks, pet exercise areas

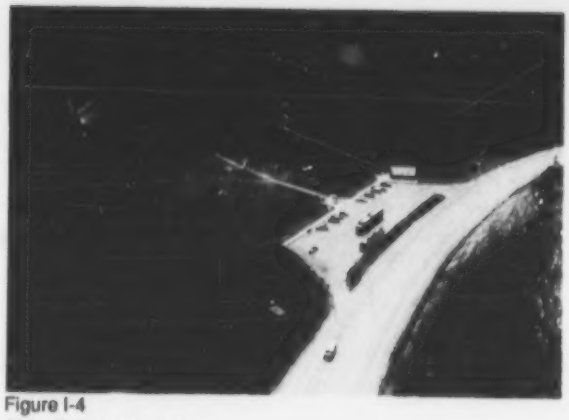


Figure I-4
Class B Safety Rest Area.

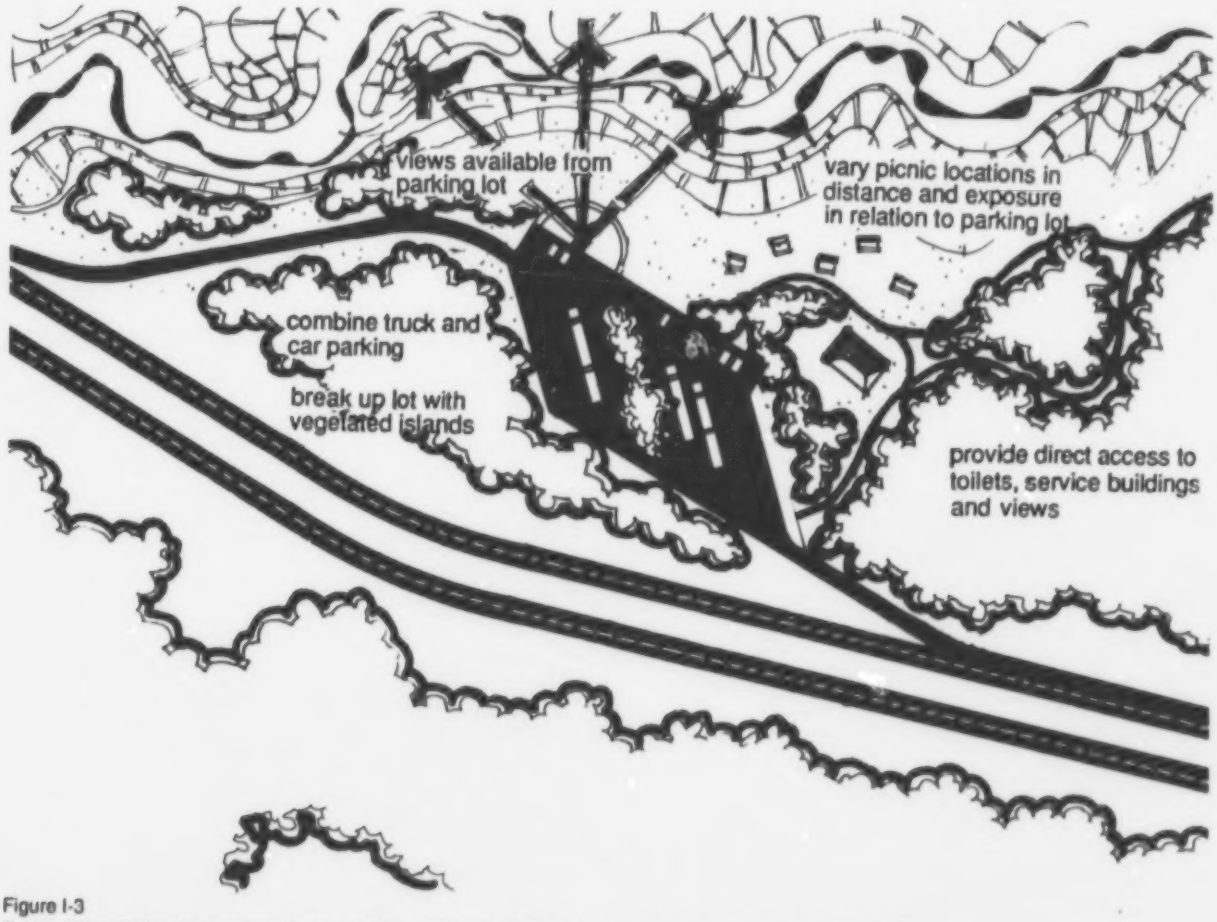

views available from parking lot
vary picnic locations in distance and exposure in relation to parking lot
combine truck and car parking
break up lot with vegetated islands
provide direct access to toilets, service buildings and views

Figure I-3
Typical Class B Safety Rest Area Schematic Plan. Note: Each Rest Area plan must respond to the local site.

.3 Safety Rest Area - Class C

- Class C Safety Rest Areas will provide smaller scale facilities in low use areas, but with various site amenities. Services will include:
  - minimum 1 each of men's and women's toilet, pit privy or chemical vault (non-flush) type units in standardized enclosures
  - viewpoints and related signage
  - tourist information signage
  - litter receptacles
  - small scale pedestrian walkway system

Figure I-6
Class C Safety Rest Area

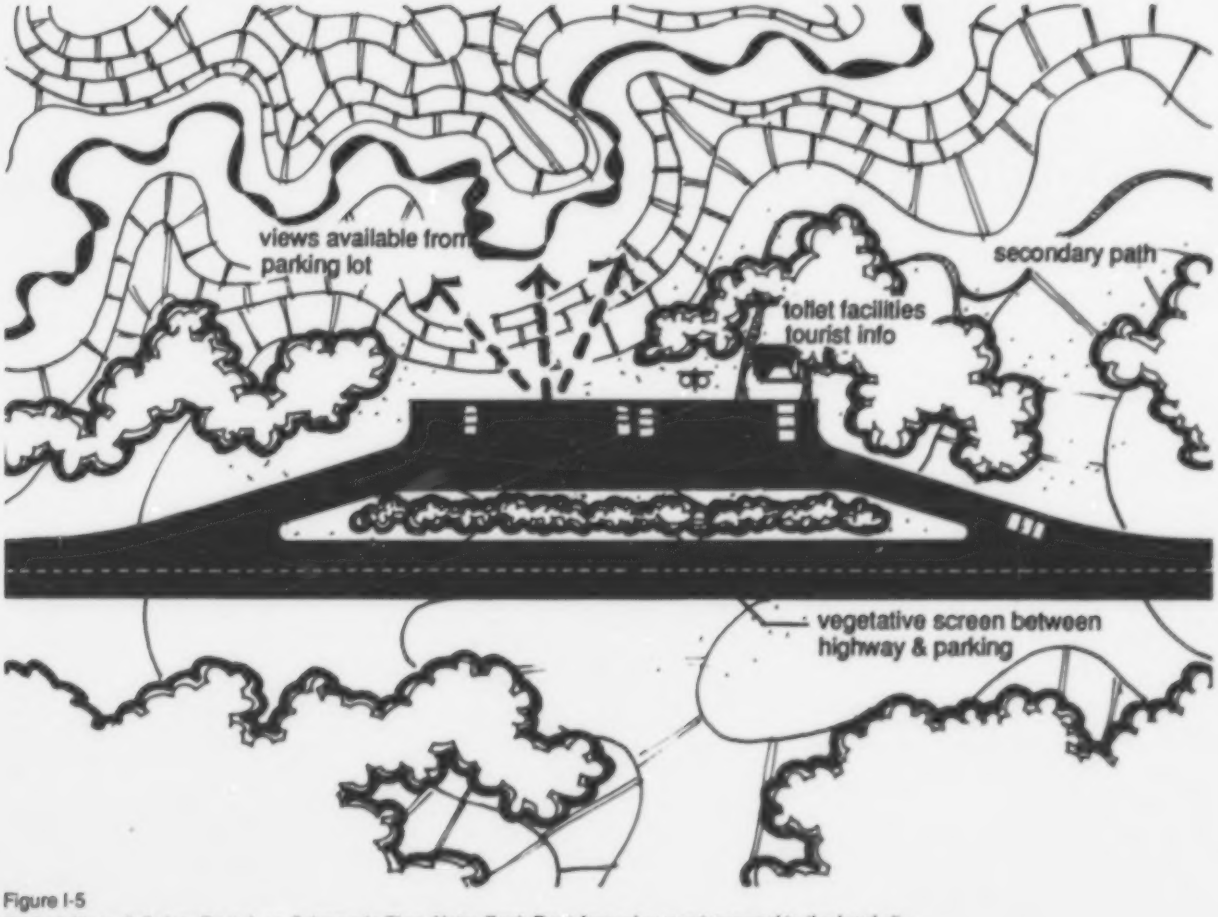


Figure I-5
Typical Class C Safety Rest Area Schematic Plan. Note: Each Rest Area plan must respond to the local site.

.4 Pullouts

- Pullouts are small facilities to provide an opportunity to enjoy views, deposit litter to receptacles, or allow slow-moving or recreational traffic to pull off the travelled way.
  - pullouts are generally intended to alleviate the hazard of vehicles stopping to access a minor view or recreational feature for which a full scale viewpoint/information area is not warranted.
  - limited services offered at pullout may include:
    - direct pullout of vehicles onto the road shoulder
    - may or may not include pedestrian areas and walkway systems, if included, these should be effectively separated from vehicular area.
    - taper the entrance/exit of the pullout.

Figure I-8
Typical Pullout.

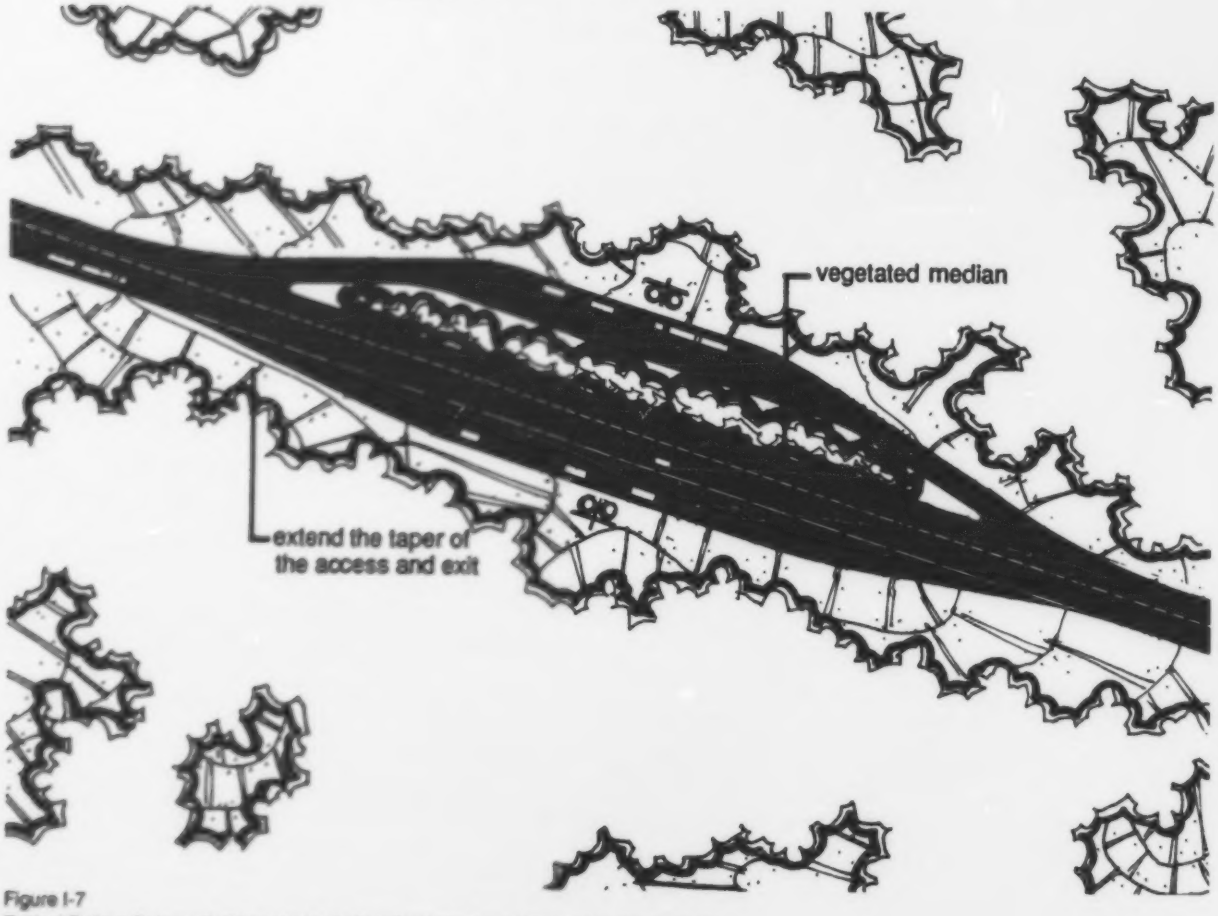


Figure I-7
Typical Pullout Schematic Plan. Note: Each pullout plan must respond to the local site.

3.0 Aesthetic Classification System and Roadside Facilities

Select spacing and appearance standards for roadside facilities in accordance with the Aesthetic Classification of the highway.

.1 Section B of this report introduces an Aesthetic Classification System which provides for all roads in B.C. to be categorized as one of:

- Baseline Highway
- Tourway
- Parkway

Table I-1 Summarizes the recommended frequency of various roadside facilities for the above classes of highway. Refer to Part 4 of this Section for more detailed standards.

Typical Frequency of Roadside Facilities

	Parkway	Tourway	Baseline Highway
Safety Rest Area, Class A	1 per hour	1 per hour	1 per hour if no other stops with public washrooms exist.
Safety Rest Area, Class B or C	1 - 3 per hour	1 - 3 per hour	if, and where, significant views or points of interest exist.
Pullout	6 per hour* or as conditions warrant	3 - 6 per hour* or as conditions warrant	where conditions warrant
Total opportunities to stop per hour	8 - 10** on two-lane highways, 2 - 5 on freeways	5 - 10** on two-lane highways, 2 - 5 on freeways	minimum 1 per hour

- * regularly spaced pullouts may not be applicable to high speed 4-lane or freeway situations. However, provision for safe stopping by vehicles should be provided where attractive views exist along the freeway, so that motorists making unsanctioned stops do not present a hazard.

- ** quantity of stop opportunities may be reduced if other public washroom facilities or stop opportunities exist along the route e.g. commercial service station, restaurants, public park. Areas which are exclusive to the general public do not qualify as stop opportunities e.g. private resorts, commercial tourist attractions.

Table I-1
Typical Frequency of Roadside Facilities

4.0 Roadside Facility Spacing Plan

Prepare a roadside facility spacing plan which identifies the approximate distribution of roadside facilities along each highway route.

.1 Roadside facilities will be considered for all limited access highway developments outside municipal boundaries (villages, towns, cities) in the province.

.2 Use Table I-1 as a guide to the approximate frequency of various types of roadside facility in different highway aesthetic classifications.

- Safety Rest Areas, Class A should generally occur within an interval of 1 hour driving time (approximately 80 km).
  - This spacing will be affected by the availability of other rest areas, existing community or commercial facilities, available sites, and other uses to be combined with the rest area.
  - The maximum spacing between opportunities for motorists to access a rest facility (private or public) should not exceed 100 km.
- Safety Rest Areas, Class B or C should generally be located where the setting or opportunity dictates, with an objective of between one and three such facilities per hour along Parkways and Tourways.
- Pullouts should be located where conditions warrant, with an objective of six pullouts per hour on Parkways, and three to six per hour on Tourways.
  - pullouts may not be appropriate in high speed four lane highways, but in these cases a practical means of providing safe stopping locations at minor viewpoints or recreation attractions must be given, so that the traffic which stops does not create a hazard. Paved shoulders may meet this requirement. Where paved shoulders are not provided, then some form of pullout would be necessary at key points.

.3 Spacing and frequency of roadside facilities will follow the above guidelines, as augmented by the considerations below:

- **Utilities**
  - Are utility services available or feasible for the roadside facility? Water supply? Wastewater disposal? Electrical?
- **Traffic Type**
  - What mix of traffic type is on the highway? Commercial / Recreational / Commuter ?
- **Spacing & Volume**
  - What frequency, mix of types and spacing of roadside facilities will be required?
  - How does this relate to existing roadside facilities along the route, including those outside of the province?
  - What services might be provided by existing communities or commercial developments readily accessible to the motorist?
- **Tourism**
  - What demands or opportunities are there for tourist information along the route?
  - Can roadside tourism information facilities be located to provide the best tourism advantage eg. just prior to attractions or communities?
- **Maintenance**
  - Can a high level of maintenance of the roadside facility be provided?
  - Is the site reasonably accessible to maintenance contractors or personnel, to provide regular and economical maintenance?
- **Quality of Service**
  - What quality of service may be provided at the roadside facility? Flush toilets?
  - Can a rest area be combined with a scenic viewpoint, or with a high amenity site eg. waterfront?
  - Can a rest area also accommodate other facilities, eg. weigh scales

5.0 Roadside Facility Site Selection Process

Complete a site selection process which incorporates roadside facility programming, conceptual plans of alternate sites, and objective means of site selection.

.1 *Write an outline facility program for each highway facility.*

- Table I-2 provides a guideline for such a program for safety rest areas and pullouts.
- Adapt the guidelines given in Table I-2 to reflect the needs and priorities of the route and the region.
- The facility program should list the objectives, components, functional requirements and capacity of the required facilities.
- Review existing and proposed private sector or other facilities along the route to ensure that highways facilities will not duplicate those already provided.

	Safety Rest Area Class A	**Safety Rest Area** Class B or C	**Pullout**
Separation from highway lanes	landscaped island, c/w solid screen of vegetation and/or earthworks	landscaped island, c/w semi-transparent screen of vegetation and/or earthworks	optional separation island
Form of parking	two areas, one each for truck/oversize and passenger car	one area, parallel oversize parking, angle car parking	short term parallel parking only
Capacity of parking	as required, maximum 60 cars, 20 oversize	as required, maximum 30 cars, 10 oversize	3 vehicles, parallel parking
Finish of parking	paved, curb, underground storm drainage	paved, with one of curb, wheel stop or posts to separate vehicle and pedestrian areas, limited underground storm drainage	paved, surface drainage, effective separation of vehicular and pedestrian areas if pedestrian areas are included
Washrooms	flush toilets, washbasins	water or chemical flush toilets to health inspector's approval	N/A
Pedestrian Circulation	primary, secondary and tertiary walk system	primary and secondary walk system minimum	in accordance with need and opportunity
Picnic area	mandatory	optional, only in areas with wash basins	N/A
Food concessions	optional - only if permanently staffed by non-highways personnel, by written contract	N/A	N/A

(cont'd on next page)

Table I-2
Guideline Facility Program

	Safety Rest Area Class A	Safety Rest Area Class B or C	Pullout
Interpretive facilities	in permanent building(s), and permanent outdoor signage to MTH approval	permanent outdoor signage to MTH approval	permanent outdoor signing to MTH approval if applicable
Tourist information	in permanent buildings, and permanent outdoor signage to MTH approval (no outlets for pamphlet distribution should be out of doors)	permanent outdoor signage to MTH approval	permanent outdoor signage to MTH approval if applicable
Building design	custom architectural design, exterior to respond to site and regional influences, floor plan similar to MTH standard design	standard MTH design	N/A
Telephone	accessible 24 hours a day, inside or outside building, underground distribution	free standing kiosk if telephone utility available on highway, underground distribution	N/A
Electrical supply and lighting	light parking areas and building area, low height decorative fixtures, underground distribution	light privy area and interior if power available on the highway, fixtures on privy building, underground distribution	N/A
Water supply	potable water to buildings, drinking fountain, public tap, and irrigation system - supply by well or alternate to health inspector's approval	potable water supply if available	N/A
Wastewater disposal	septic field or alternate to health inspector's approval	septic field or pump-out privies for Class B, pit privies for Class C, all to health inspector's approval	N/A
Litter control	provide litter containers distributed along pathways, with central collection depot in screened location separate from public areas	provide litter containers adjacent to parking areas and picnic area, accessible for garbage collection	provide litter container and program for regular litter pickup
Pet exercise area	separate from food/picnic area and building	N/A	N/A
Other features to consider if demand warrants	sani-dump, cultural/historical exhibits, benches/seating areas, flower gardens/shrub display, telescopes, playground	cultural/historical markers, viewing decks	cultural/historical markers
Other facilities which may be combined	viewpoint, information areas, weigh scales, toll plaza (nearby), access to secondary road	N/A	N/A

Table I-2 (cont'd)

.2 Collect base data for each route, at a scale and detail adequate to allow identification of potential roadside facility sites (e.g. 1:5000). Data collected should include:

- topography and physical features
- vegetation pattern
- water features and drainage patterns
- viewpoints accessible from the highway
- historical and cultural attractions along the route
- interpretive opportunities along the route
- recreation opportunities along the route
- soil and geotechnical patterns, hazard zones
- cadastral information and general ownership status and land use
- Agricultural Land Reserve boundaries
- utility services available along the route

- To limit data gathering expense for Baseline Aesthetic Class highways, it may be feasible to limit data collection to study areas identified by the roadside facility spacing plan created earlier.

.3 Select candidate sites.

- The emphasis in roadside facility planning and location should be on selecting the highest quality site possible.

- Primary considerations in the site selection process should be:

  - site amenity, including views, attractive vegetation, and water features or other recreational amenities if available
  - available utilities if required eg. availability of water, and appropriate methods of wastewater disposal
  - reasonable adherence to the intent of spacing plans
  - adequate size and terrain to accommodate programmed uses, and for reasonable access and geometrics. In high speed four lane developments, space from the nearest interchange to the ramps for a roadside facility should be 1.6 km minimum, unless the roadside facility is serviced by the interchange
  - limited impact on environmental quality, or environmentally sensitive areas
  - freedom from unsurmountable physical constraints of soil stability / geotechnical conditions, groundwater, geological or climatic hazards
  - reasonable land acquisition costs and owner co-operation. Compatibility and good separation from adjacent uses

- Take advantage of unique site opportunities to create memorable facilities, eg.

  - changes in vegetation communities
  - interesting landforms or topography
  - water features
  - historical or cultural features
  - nature interpretation opportunities

.4 Field visit candidate sites.

- It is imperative that designers/ planners visit candidate sites to assess attributes and opportunities.

- It may be possible to limit the number of candidate sites to a reasonable quantity for further investigation, based on the field visit.

.5 Conduct thorough site analysis of each remaining candidate site indicating physical features and unique aesthetic qualities including:

- slopes
- physical features / topography
- climatic and microclimate considerations
- soil and geotechnical considerations
- drainage patterns
- utilities / services available
- obtain base data at 1:1000 scale to allow assessment of site features indicating:
  - legal survey and existing utility information
  - existing contours at an interval of 1m or smaller
  - survey of existing vegetation

.6 Produce functional relationship diagram, access alignment study, and design concept for each candidate site.

- Functional relationship diagrams (bubble or schematic plans) allow the planner to envision how the site might be developed in the coarsest sense.
- Several different bubble diagrams might be attempted for each site, to assess the capability of the site.
- Record any special problems or opportunities which become evident as a result of the functional relationship diagrams.
- Select the most promising relationship diagram, and proceed with road alignment geometry studies.
  - determine whether reasonable horizontal and vertical curves can access the site.
  - keep in mind that roadside facilities are a slow speed environment, and that highway standard geometrics need not rigidly apply.
- Proceed to add the proposed siting of buildings, parking, pedestrian walk systems, and picnic areas or other facilities as identified by the program. Refine these into an overall design concept for the site.

.7 Determine each candidate site's availability of utility services, including:

- water
- wastewater disposal
- electrical
- telephone

.8 Compare candidate sites by objective means, including:

- relative capital cost
- relative maintenance cost
- relative range of facilities offered
- relative attractiveness to users
- relative environmental impact
- relative contribution to the highway aesthetic experience
- compatibility with staging plan
- perceived cost benefit

.9 Select preferred sites.

- if no sites appear to be large enough to accommcdate all required elements, consider an additional location, i.e increase frequency of rest areas.
- sites selected may include rest areas, viewpoints, information areas, and pullouts as identified in the spacing plan.

.10 Document the base data generated, alternatives considered, and rationale for the selection made.

- Pass information on to detail design team if different than the site selection team.

6.0 Roadside Facility Design Process

Design and develop roadside facilities with attention to detail appropriate to the close inspection which the facility will receive.

- Roadside facility design must pay attention to an additional level of detail not appropriate to highway design.
  - roadside facilities are unique in highway planning as they are subject to viewing at either low traffic speed or by pedestrians
  - preservation of existing site character and response to aesthetic opportunities is imperative
  - the scale of the final facility relates to the pedestrian and is thereby more intimate than highway scale. The design process must reflect the increased level of detailed decision-making required.
- The site planning and design process to address this level of detail can be summarized as follows:

.1 Complete detail survey and site analysis:

- Scale 1:250
- Contour interval 0.5m geodetic
- Survey should locate elements marked in the field by the designer, eg.:
  - tree groupings or individual trees
  - rock outcrops
  - water features
  - historical features
  - existing trails
- Designer should complete detailed on-site analysis of:
  - views and vistas
  - site character
  - health and type of existing vegetation
  - existing slopes, topography and drainage
  - potential trail routings
  - existing microclimate areas
  - existing wildlife
  - other site features
- Specialized studies should be completed on:
  - soil suitability, for
    - bearing capacity, use as fill
    - landscape topsoil
    - sewage disposal suitability
  - water supply, for
    - groundwater assessments or test wells
    - discussions with adjacent municipalities or regional districts re water supply
  - property acquisition issues, eg.
    - legal boundaries
    - easements and other encumbrances
    - appraised value
    - owner attitude towards disposition
  - environmental issues, eg.
    - wildlife habitat
    - sensitive environmental areas
- Document these detailed site analyses for use by the design and construction team.

.2 Refine the design concept created in the site selection process in response to the new information generated.

- Reassess the location of the major site components.
- Review functional relationships among site components:
  - for purposes of clarity, functional relationships can be classified as:
    - compatible - eg. picnic areas and scenic rest areas.
    - incompatible - eg. picnic areas and trailer dumping facilities.
  - mitigation techniques may be utilized to ease conflicts between incompatible uses including:
    - buffering - eg. earthworks for noise abatement
    - screening - eg. plantings between picnic areas & unsightly views
    - physical separation - eg. provide space between incompatible uses.
  - consider techniques to enhance relationships between compatible uses:
    - retain adjacent relationships between related uses but offset locations for increased aesthetic experience - eg. washrooms sited close to parking but offset enough to allow enjoyment of pleasant surroundings, and views available between parking areas and washrooms, with seating provided to enjoy views while waiting .
- Identify the conceptual relationship of the building to the site, i.e.:
  - orientation
  - access point(s)
  - building form - single or multi-level
  - site features to incorporate with building design eg. rock outcrops, slopes, existing trees, views or backdrops.

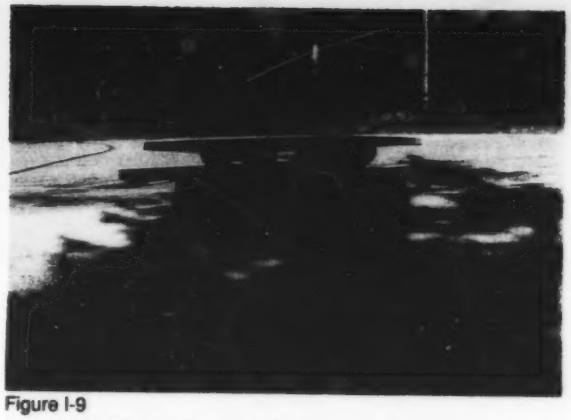


Figure I-9
Include provision for access and enjoyment of rest areas by physically challenged individuals. Note the extended table top and slab at this table.

Figure I-10
Good relationship between parking and picnic area - convenient, but with some separation.

Figure I-11
A custom designed building for a rest area.

- Refine roadway access/egress and alignments:
  - Rest Areas and Viewpoint/Information areas on limited access highways will be designed with adequate merge lanes, acceleration and deceleration lanes so as not to obstruct traffic on the mainline highway, and with sufficient advance signage to allow for reaction time by the driver for access.
  - identify relationship of access road to site, use opportunities to use existing or created landform and vegetation to slow down traffic, create a gateway feeling, or create a sense of mystery.
- Refine parking area size, shape and general configuration
  - amount of parking sets limitations on facility use - avoid overabundant parking, as this may lead to overuse of the site.
  - include provisions in parking lot for the physically challenged, with curb drops to allow access from parking area to pedestrian walkway system.

Figure I-12
Create curbed islands and curvilinear entrance roads.

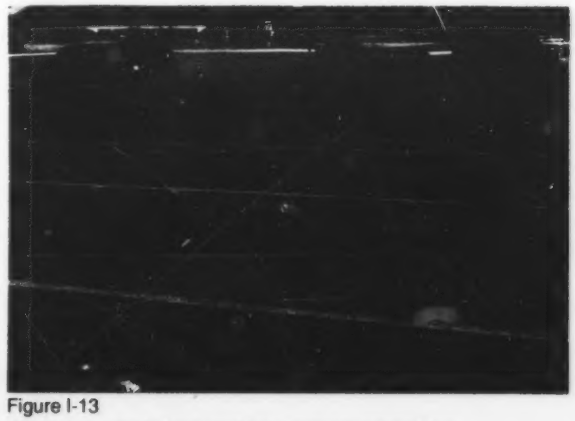


Figure I-13
Avoid excessively large parking areas for car parking.

- Identify location of any special features or facilities eg.
  - lookout points
  - interpretive signage
  - pet exercise area

Figure I-16
A scenic overlook without adequate protection for pedestrians.

Figure I-14
Provide interpretive display and photo opportunity.

Figure I-17
A scenic overlook with reasonable pedestrian protection. Note innovative combination of post barriers and signage

Figure I-15
Marsh outlook. Note deck to control access to marsh.

Figure I-18
Interpretive signage grouped at the end of a short secondary path.

- Identify a hierarchical pedestrian system:
    - primary paths should link parking to building and major attraction.
    - secondary paths should service picnic area, minor facilities and provide strolling opportunities
    - tertiary paths should be rustic trails for more extended walking, through wood/meadows or other unmanicured areas.
  - primary and secondary paths should be accessible to physically challenged to National Building Code standards.

Figure I-19
Primary path to building and site features.

Figure I-20
Secondary path located away from major circulation area.

.3 Perform field review of the design concept by the designer:

- Walk through the design
- Lay out the major components.
- Mark notations/refinements on a design plan right in the field - this will provide a reminder in the office.
- Incorporate the refinements into the final design.

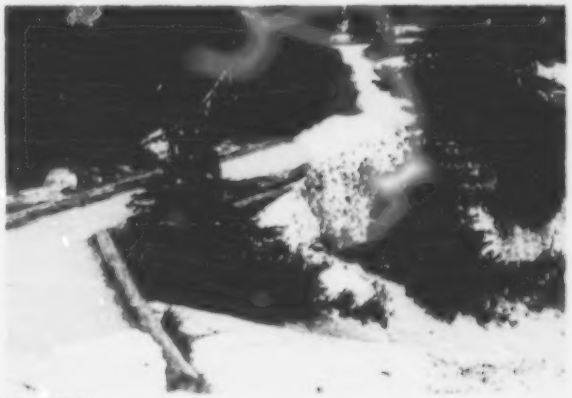


Figure I-21
Tertiary path. Note closeness to nature in this path.

Figure I-22
Tertiary path. Emphasis in tertiary path design should be on exposing the natural attributes of the site.

.4 Complete preliminary detail design of road/parking area alignment and grades:

- Meet the deceleration/acceleration and sight distance requirements of the highway.
- Relate to freeway profiles with access ramps.
- Provide a visually interesting entrance to the facility
  - determine how existing vegetation can be used to advantage.
  - align roads and design grades to save desired existing vegetation and site features.
  - plan drainage patterns to minimize the amount and depth of ditches along entrance ramps.
- Reduce visual scale of parking areas as much as possible.
  - screen parking areas from highway
  - leave islands of native or planted landscape and berms within larger parking areas, to break down the expanse of pavement into small spaces.
  - for rest areas produce a conceptual underground drainage plan, showing location of drain inlets and storm collection system and outfalls. Co-ordinate this with vegetation and features to remain.
- Produce a contour plan of the roadway and parking area and environs, showing the integration of the access roads and parking into the site.

.5 Complete preliminary grading plans for overall site.

- Extend the grading design exercise throughout the balance of the facility site.
  - identify areas to be saved as no cut/no fill areas.
  - produce contour plans around building, picnic area, walkways, and other facilities.
  - identify drainage pattern and any necessary underground storm drainage.
- Note that overall site grading may identify some problems which require refinement to the parking areas or access road grading.

.6 Complete preliminary building and utility layouts.

- Building
  - produce general concept of building floorplan and elevations.
  - produce detailed site plan and grading plan for the area immediately around the building.
- Water
  - mark location of well or other water supply on site plan.
  - design schematic distribution system, allowing for irrigation supply connections if applicable, and avoiding trees and landscape features to remain with pipe routings.
  - provide a preduct plan to guide the installation of sleeves for future irrigation if applicable. This will require a conceptual layout of the irrigation system.
- Wastewater
  - locate septic fields in conjunction with the overall site plan
    - eg. locate septic fields under picnic or open play areas.
    - consider splitting a large septic field into two smaller fields separated by existing vegetation, to avoid an oversize clearing.
  - route sewer pipe around trees/features to remain.
  - consider required maintenance access routes to facilities i.e. sewage tank or pumpout - these could be combined with walkway alignments to avoid unnecessary pavement or site disruption.
- Electrical & Telephone
  - locate pole drop in a low visibility location - not in a viewing area.
  - provide underground distribution throughout at rest areas or viewpoint/information areas.
  - route distribution around landscape features to remain.

.7 Cost estimating

- Produce detailed cost estimates for:
  - land cost
  - capital cost
  - maintenance and operation cost
- Confirm that budget has been allocated.
- Confirm that costs are affordable within allocated budget.
- Select priorities to bring project within approved budget.

.8 Working Drawings and Specifications

- On approval of detail design and related budgets, prepare working drawings including the following:
  - site layout plans
  - site grading plans
  - site utilities
  - planting and vegetation management plans
  - irrigation plans (if applicable)
  - road and utility profiles
  - architectural plans, elevations and details for buildings and structures
  - construction details as required
- Produce written specifications and Special Provisions:
  - Invitation to Tender
  - Instructions to Bidders
  - Form of Tender
  - Form of Contract
  - Supplementary General Conditions
  - Technical specifications

.9 Field Reviews During Construction

- Provide field review and contract administration services during construction as required by the scope of the construction.
- Field review services should include:
  - flagging of existing vegetation/features to remain.
  - confirmation of protective fencing around same.
  - field review during selective clearing operations.
  - field reviews during rough grading.
  - review of final rough grade prior to spreading topsoil.
  - review of topsoil placement.
  - review of selective pruning.
  - review of imported plant materials at the nursery.
  - review of planting and tree staking in the field
  - hydrostatic tests and pipe bedding review for irrigation.
  - coverage review for irrigation.
  - review for substantial performance.
  - review(s) for maintenance performance.
  - review for final performance.

7.0 Use of Professionals

Regional Managers are encouraged to appoint the appropriate specialist disciplines to the planning and design of roadside facilities.

.1 The professionals involved and their associated duties should include:

- **Landscape Architect** as project coordinator, and responsible for overall planning and design, site working and grading drawings, and field reviews.
- **Civil Engineer** for utility supply, and detailed design of roadway and utility systems, and bulk fill and excavation aspects.
- **Architect** for design of buildings and overhead structures. The Architect may be supplemented by mechanical, structural and electrical engineers in detailing of proposed site buildings.
- **Environmental Specialist** for assessment of the implications of development for adjacent waterbodies, fisheries, and wildlife.

.2 Appointment of Landscape Architects to the project should be at the earliest possible date during the alignment studies for new highways. This early appointment will allow roadside facility design to go in tandem with highway design.

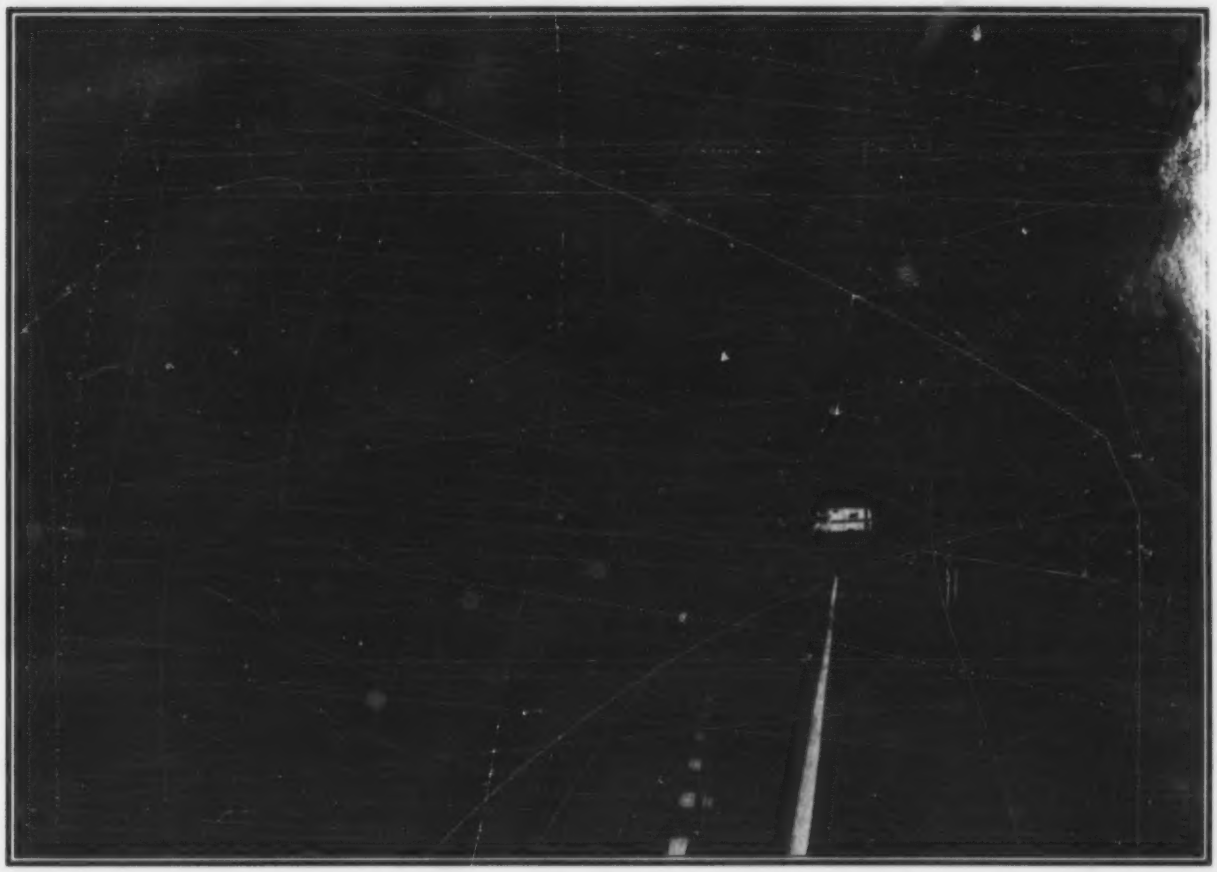
8.0 Summary of Roadside Facility Planning and Design Method

.1 The Site Selection Process for rest areas should include:

- Spacing analysis.
- Base data collection of topography, vegetation, cadastrals, soils, visual analysis, airphotos for study area.
- Identify candidate sites.
- Field visit candidate sites.
- Analyze candidate site qualities.
- Produce schematic concept diagrams for candidate sites.
- Determine availability of water, wastewater disposal, and electrical, by on site means or connections to municipal systems.
- Compare candidate sites by objective means.
- Select preferred site(s)
- Document site selection process, and make available all base data to rest area designers.

.2 The Detail Design and Construction Process for rest areas should include:

- Detail survey of rest area site, with 0.5 m contours, and location of special elements marked in the field by the designer (eg. existing trees, rock outcroppings, water features, historical features, trails, etc.)
- Refinement of schematic concept diagrams to respond to detail survey.
- Field review of schematic concept by the designer.
- Preliminary design of road/parking area alignments and grades. Road grades should relate to both the proposed freeway profiles, and existing topography, using the contour method.
- Preliminary grading design of the overall site. This will allow for relation of proposed buildings, picnic areas, and landforms to existing topography and to proposed roadways.
- Preliminary utility and building layouts. These should address the extent of underground storm drainage and ditches, location of wells and septic field, routing of electrical supply, and siting of buildings in relation to grades.
- Cost estimates and confirmation of budget and scope of project.
- Working drawings to include site layout, site grading, site utilities, planting, irrigation (if applicable), road and utility profiles, architectural plans for buildings and structures, construction details and specifications.
- Field reviews during construction, by the designer of the rest area, to encourage adherence to the intent of the design and specifications. This could be supplemental to the administration of the Field Engineer.



Above Ground Utilities

Above Ground Utilities

Introduction

Above ground utilities include lighting, power, and telephone lines which service roadside facilities and/or adjacent communities, residences, and businesses. By nature, these utilities can parallel the highway for great distances. The continual presence and sheer repetition of these structures demands attention and design approaches completely different than that given to other roadway structures.

Recommended Practices

The following pages outline recommended practices concerning the aesthetics of utility installation for highways in B.C., as summarized below:

1.0 Scale of structure should complement both the design speed and the scale of the highway.

2.0 Place above ground utilities to minimize the disruption of views from the highway.

3.0 Integrate utility structures with adjacent landscapes and with the characteristics of the region in which they are placed.

4.0 Select the type, placement and level of illumination to facilitate safe and aesthetic night driving.

5.0 Consider the artistic application of lighting for visual variety and the increased attentiveness of the driver.

1.0 Scale of Structure

Specify structures, which will be of an appropriate scale and proportion, and which will compliment the design speed, and the scale of the highway.

.1 Adjust the height and proportion of utility structures, recognizing that a structure gains in physical prominence as design speeds decrease.

.2 Adjust the height of light standards to compliment the scale of the highway and adjacent existing vegetation.

- Light standard height should not exceed dimension of the pavement width, where such height limits are feasible.

2.0 Location of Utility Structures

Place utility structures to minimize the disruption of views from the highway.

.1 Locate lighting utility standards as an integral component of the highway.

- Place lighting at minimum setback distance required for highway design speed.
- Locate lighting in boulevards not in the median of divided highway.

.2 Locate power and telephone utility lines for minimal visibility from highway.

- Depending on economics and availability of land, one or all options may be applied.
  - provide a separate alignment for telephone and power utility lines behind 10m minimum width screen where natural treed conditions exist.
  - combine lighting, power and telephone into shared pole facility, where power services to lighting is above ground.
  - where power service to lighting is underground locate telephone and power utility line at farthest setback from pavement edge possible, commensurate to protection of designated views and minimum clearing of adjacent natural vegetation.
  - in locations of high visibility place all services underground so as not to interfere with the views from and toward the highway.

Figure J-1
In this example utility poles have been located away from the highway to preserve a particularly important view adjacent to a tourist facility.

.3 Locate lighting standards, telephone and power poles out of designated views and "areas of effective vision".

- Where a view, clearing, or open countryside appears to one side locate poles and standards to the opposite side.
- Where views on the curve remain equal locate standards and poles to the inside curve.
- Where views on tangents remain equal locate standards and poles to the side opposite of the approaching curve's predominant view.

Figure J-2
In this example utility poles have been located on the outside of a curve within the area of effective vision.

Figure J-3
This situation is much better where utility poles are not within the area of effective vision.

.4 Minimize the number of utility structures.

- Use the widest practical spacing between fixtures, commensurate with height of standard and uniformity requirements.
- Combine lighting standards and other power poles into a shared pole facility.
- Use other highway structures such as retaining walls and exposed cliff faces, and bridge and overpass infrastructure as replacements for light standards.

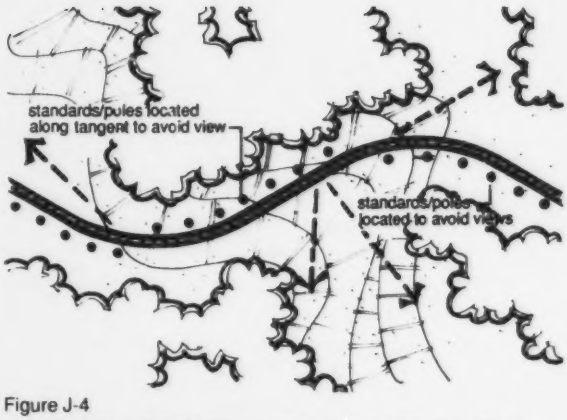


Figure J-4
Locate poles and standards on curve and/or tangent to side of road away from significant views.

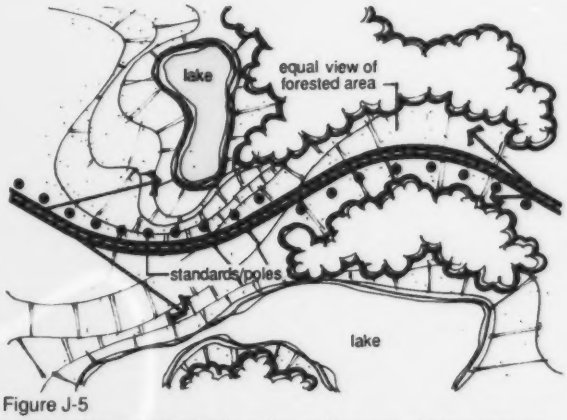


Figure J-5
Locate poles and standards to the inside curve, where views are equal.

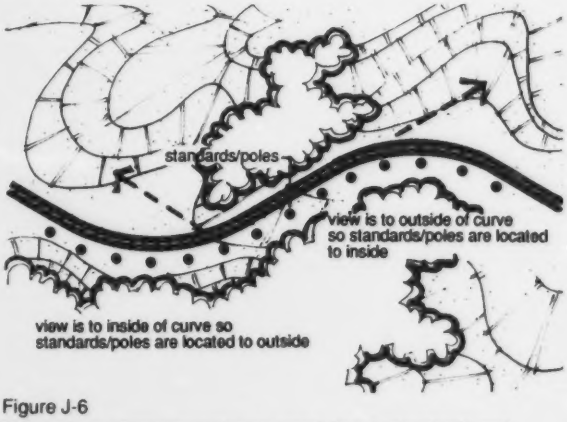

standards/poles
view is to outside of curve
so standards/poles are located
to inside
view is to inside of curve so
standards/poles are located to outside

Figure J-6
When views along tangents are equal, locate standards and poles to the side opposite the approaching curve's predominant view.

3.0 Integration with Adjacent Vegetation and Earthwork

Integrate utility structures with adjacent landscapes and the characteristics of the region in which they are found.

.1 Integrate lighting standards and power and telephone poles with adjacent vegetation.

- Where clearing and grubbing of trees is required to accommodate utility structures provide the minimum setback distance allowed.
- Use existing and planted trees as backdrops to utility structures which must be placed at roadside.

.2 Integrate lighting standards and power and telephone poles with adjacent earthwork.

- Investigate opportunities of attaching utility lines to cliff faces in confined places, or to avoid obstruction of views
- Locate utility lines along a cliff top, rather than running lines over the cliff top.
- Where utility lines must follow topography which creates a silhouette of the line against the horizon, locate lines behind a vegetative screen of 10m minimum width.

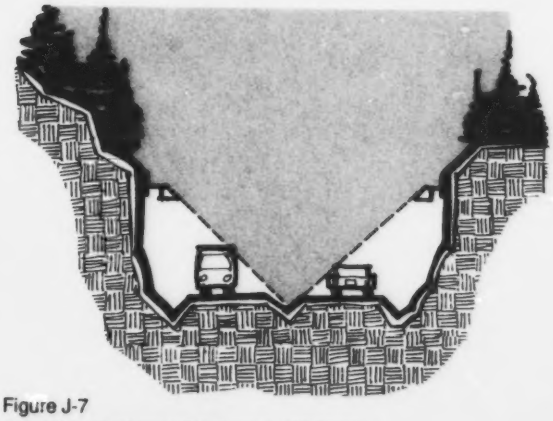


Figure J-7
Consider attaching utility lines to cliff faces.

.3 Parkway and Tourway lighting structures should be a colour which is responsive to the characteristics of the region in which they are found.

- Respond to colour characteristics of the region. Suggested colours might be:
  - medium khaki green or warm grey for forested backdrop.
  - medium khaki green or warm grey for wetland backdrop.
  - light khaki green or warm grey for grassland backdrop.
- The colour of lighting structures should be standardized along a route.

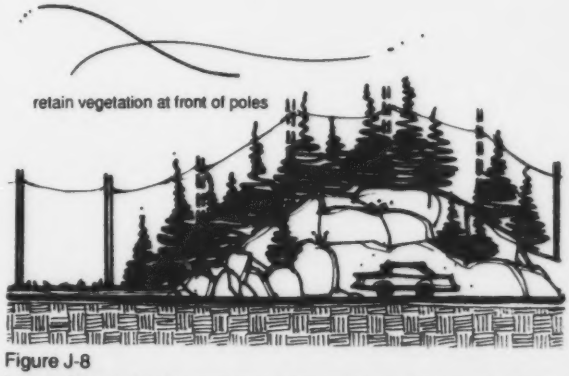


Figure J-8
Locate lines behind a vegetative screen where lines must follow topography.

4.0 Type, Placement, and Level of Illumination.

Determine the type, placement, and level of illumination to facilitate safe and aesthetic night driving.

.1 Minimize glare upon entering lit highway segments from unlit segments, and between suburban and rural areas.

- Diminish the spacing between light standards until typical spacing is achieved, so as to diffuse the sudden glare upon entering lit areas.
- Utilize 'reduced glare' or 'sharp cut-off' fixtures in transition areas between unlit and lit zones.

.2 Minimize the glare or visual nuisance of highly lit highway segments to adjoining residences.

- Provide a treed screen of 10m minimum width between affected residences and highway lighting.

.3 Provide adequate and complementary scaled lighting for signs.

- Signs not adequately visible by fluorescence should be lit by attached overhead light, matching the length, scale and colour of the sign.

.4 Provide both safe and functional lighting of all highway facilities.

- Light all parking areas, typical to illumination of urban parking areas.
- Light immediate exterior area of all structures within roadside facility areas, at an adequate level to safeguard against vandalism of property and attack on facility user.

Note: The type and level of illumination chosen is conditional with economics. Type and level of illumination must first be commensurate to safety and functional requirement.

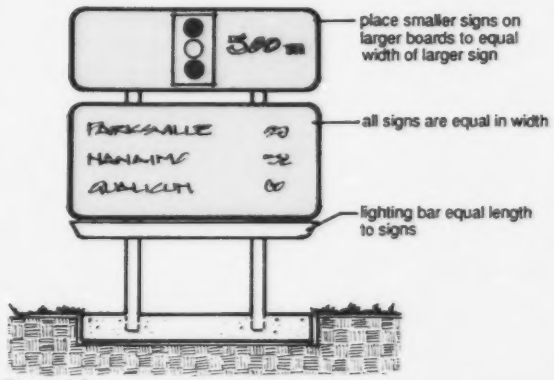

place smaller signs on larger boards to equal width of larger sign
all signs are equal in width
lighting bar equal length to signs

Figure J-9
Lighting for signage should match the length, scale and colour of the sign.

5.0 Artistic Application of Lighting

Consider the artistic application of lighting to provide visual variety and the increased attentiveness of the driver.

.1 Provide illumination of outstanding highway structures.

- Appropriate structures would be bridges, overpasses, and well detailed retaining walls.

.2 Provide illumination of outstanding natural features which may be easily featured from the roadside.

- Appropriate features would be waterfalls, individual landmark trees and rock outcrops, and cliff faces.

.3 Give increased consideration to artistic application of lighting to any structures and features described above, as means of giving variety to driver's experience as mentioned under Visual Resource Analysis.

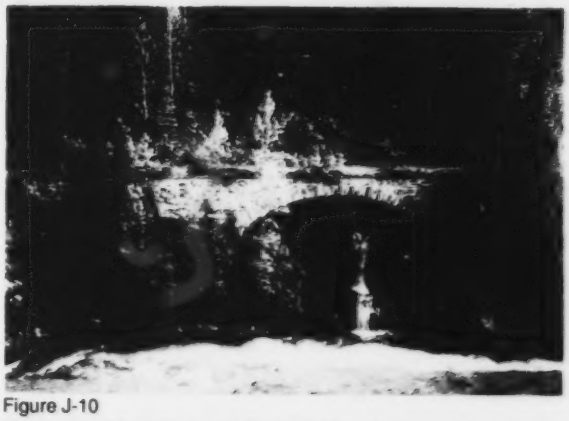


Figure J-10
Illuminating this water cascade and bridge structure will create an interesting night driving experience.

References

- AASHO, **A Guide for Highway Environment Design**, Washington, D.C., 1970.
- Alberta Transportation, **Alberta Roads, Environmental Design Guidelines**, prepared by TES Research and Consulting, Edmonton, Alberta, 1980.
- Appleyard, D., Lynch K., and Meyer, J.R., **The View From the Road**, Cambridge, Massachusetts, 1964.
- B.C. Land Commission, **Spallumcheen: The Visual Environment**, prepared by W.C. Yeomans, Burnaby, British Columbia, 1977.
- Coon, F.W., et al., **Practical Highway Aesthetics**, prepared for the American Society of Civil Engineers, Highway Division, New York, New York, 1977.
- Crowe, S., **The Landscape of Roads**, London, England, 1960.
- Dare, C.E. and Carstens, R.L, **Final Report, Cedar Rapids I-380: Freeway Noise, Multiple Land Use, and Aesthetics Study**, prepared for Engineering Research Institute, Iowa State University, Ames Iowa, 1973.
- Dunball, A.P., **Landscape Treatment of Trunk Roads and Motorways, Arboricultural Association Journal**, February 1972.
- English Tourist Board, **Signs of the Times 84**, London, England, 1984.
- English Tourist Board, **Tourism Signposting**, London, England, 1982.
- Hornbeck, P.L., **Highway Aesthetics - Functional Criteria for Planning and Design**, Cambridge , Massachusetts, 1968.
- Hough, M., **The Contributions of Landscape Architecture to Highway Design, Engineering Journal**, September, 1967.
- Ontario Ministry of Natural Resources, **Design Guidelines for Forest Management**, prepared by Hough, Stansbury and Associates Ltd., Toronto, Ontario.
- Province of British Columbia, **Freedom to Move: Overview of Provincial Transportation System, Vol. 1, 3, 12, 15**, Victoria, British Columbia, 1987.
- Province of British Columbia, Environment and Land Use Committee Secretariat, **Guidelines for Benefit-Cost Analysis**, Victoria, British Columbia, 1977.
- Province of British Columbia, Ministry of Environment, Resource Analysis Branch, **Proceedings: Visual Analysis Workshop, Parksville, British Columbia**, Victoria, British Columbia, 1977.
- Province of British Columbia, Ministry of Environment, **Visual Resource Assessment - A User Guide, Manual 2**, Victoria, British Columbia, 1983.
- Province of British Columbia, Ministry of Forests, **Biogeoclimatic Units of Central and Southern Vancouver Island**, Victoria, British Columbia, 1979
- Province of British Columbia, Ministry of Forests, **Forest Landscape Handbook**, Victoria, British Columbia, 1981.
- Province of British Columbia, Ministry of Parks, **Preserving our living legacy: Parks Plan 90: Landscapes**, Victoria, British Columbia, 1990.
- Province of British Columbia, Ministry of Highways and Public Works, Design and Surveys Branch, **Highway Design Manual of Standards and Instructions**, Victoria, British Columbia, 1988.
- Province of British Columbia, Ministry of Transportation and Highways, Traffic Branch, **Manual of Standard Traffic Signs**, Victoria, British Columbia, 1988.
- Roads and Transportation Association of Canada, and Transport Canada, **Manual of Geometric Design Standards for Canadian Roads, 1986 Edition**, Ottawa, Ontario, 1986.
- Schiechtl, H., **Bioengineering for Land Reclamation and Conservation**, sponsored by the Province of Alberta, Department of Environment, Edmonton, Alberta, 1980.
- Tunnard, C. and Pushkarev, B., **Man-Made America: Chaos or Control**, New Haven, Connecticut, 1963.
- U.S. Department of Agriculture, Forest Service, **National Forest Landscape Management, Vol. 2, Chp. 1, The Visual Management System**, Washington, D.C.
- U.S. Department of Agriculture, Forest Service, **National Forest Landscape Management, Vol. 2, Chp. 4, Roads**, Washington D.C.
- U.S. Department of Agriculture, Forest Service, **National Forest Landscape Management, Vol. 2, Chp. 5, Timber**, Washington, D.C.
- U.S. Department of Commerce, **A Proposed Program for Scenic Roads and Parkways**, Washington, D.C., 1966.
- U.S. Department of the Interior, National Park Service, **Plants, People, and Environmental Quality: A Study of Plants and Their Environmental Functions**, Prepared in collaboration with the American Society of Landscape Architects, Washington D.C., 1972.

- U.S. Department of Transportation, Federal Highway Administration, Bureau of Land Management, and Colorado Highways, **Colorado I-70 Scenic Lands: Preserving/Enhancing the Visibility from Interstate 70 of National Resource Lands in Colorado**, Washington D.C., 1975.
- U.S. Department of Transportation, Federal Highway Administration, **I-70: In A Mountain Environment, Vail Pass, Colorado**, prepared by Colorado Department of Highways, 1978.
- U.S. Department of Transportation, Federal Highway Administration, **Safety Rest Area: Operations and Maintenance**, prepared by Arizona Department of Transportation, Washington D.C., 1980.
- U.S. Department of Transportation, Federal Highway Administration, **Safety Rest Area: Planning , Location, and Design**, prepared by Minnesota Department of Transportation, Washington D.C., 1981.
- U.S. Department of Transportation, Federal Highway Administration, **Visual Values for the Highway User: An Engineer's Workbook**, prepared by Hornbeck, P. and Okerlund Jr., G., Washington, D.C., 1973.
- Yeomans, W.C., **Landscape Architecture and the Visual Resource**, sponsored by Environment and Land Use Committee Secretariat, Victoria, British Columbia, 1975.

List of Figures

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Most highways in British Columbia are built through areas of spectacular scenery. Highways which do not respond to this aesthetic context are a lost opportunity.

Figure A-2 1
Highways should strive to contribute positively to this aesthetic quality of this province.

Figure A-3 2
This pragmatic solution to controlling stormwater runoff is aesthetically unacceptable.

Figure A-4 2
This culvert outflow has been constructed to create an effective and well concealed transition between the pipe and stream.

Figure A-5 2
In this example earthworks have been designed to minimize headlight glare and simulate adjacent topography.

Figure A-6 2
All areas within the highway right of way must be designed and maintained to create an attractive and orderly image. This area between a highway and frontage road looks unfinished and invites abuse through littering and off-road traffic.

Figure A-7 2
The treatment of roadsides, and medians should be simple and responsive to the character of the adjacent topography.

Figure A-8 2
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Figure A-9 3
This manual is written to respond to the broad range of conditions evident throughout B.C.

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B.C. Ministry of Parks (June 1990)

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Figure C-22 23
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Figure C-25 26
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Figure C-26 26
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Figure C-27 26
Experience 4: tangent, focus on landmark.

Figure C-28 26
Experience 5: viewpoint/information area.

Figure C-29 26
Experience 6: curvilinear alignment, more open countryside.

Figure D-1 32
Align vertical and horizontal curves with co-incident midpoints.

Figure D-2 32
Where vertical and horizontal curves do not coincide the vertical curves should lead.

Figure D-3 32
Arc and spiral highway design.

Figure D-4 32
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Figure D-5 33
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Figure D-6 33
Tangents should focus on natural or man-made landmarks.

Figure D-7 33
Ideal angle and distance from landmark.

Figure D-8 33
Skirt the edge of clearings and sensitive areas.

Figure D-9 34
Align roadway at the margin between scree slopes and vertical rock face.

Figure D-10 34
Terraced cut slopes allow for subsequent revegetation.

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Respond to vegetation patterns while traversing hillsides.

Figure D-12 34
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Figure D-13 35
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Figure D-14 35
Views from the roadway can be accommodated without impacting the shoreline.

Figure D-15 35
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Figure D-16 36
Do not encroach on water bodies closer than 7.5 metres. This roadway would be better with a vegetated buffer between it and the river.

Figure D-17 36
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Figure D-18 36
Roadway alignment should not require clearing which overwhelms the natural dimensions of waterbodies.

Figure D-19 36
Bridges should become an extension of the curvilinear alignment of adjacent roadways.

Figure D-20 37
Align road through natural gullies or created breaks.

Figure D-21 37
Angle the vertical approach into the valley at a minimum of 3 degrees, to show a perceivable response to the valley.

Figure D-22 37
Angle the horizontal approach into the valley at a minimum of 3 degrees, to expose views away from the road to the valley length and walls.

Figure D-23 37
Bridges should be designed as part of the horizontal and vertical alignment of the adjacent road. This straight bridge interrupts an otherwise graceful curvilinear alignment.

Figure D-24 38
Focus on landmarks such as mountains, predominant hills, landmark trees, forests, shelterbelts, and/or landmark buildings.

Figure D-25 38
Cross the edges of landscape units as this highway does passing from a forested area in the foreground, to an open grassland, and back into the forest in the distance.

Figure D-26 38
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Figure D-27 38
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Figure D-28 39
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Figure D-29 39
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Figure D-30 39
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Figure D-31 39
In this photograph signs have been erected to warn motorists of restricted visibilty as a result of a short vertical curvature.

Figure D-32 40
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Indicates minimum stopping sight distances at various design speeds. (Taken from RTAC)

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Figure D-39 41
Shrubs used for median planting can provide an additional measure of crash protection.

Figure D-40 42
For divided highways avoid convergent alignments where headlights will shine into the path of oncoming traffic.

Figure D-41 42
In this photograph, vegetation within the median minimizes the impact of headlights from oncoming traffic.

Figure D-42 42
A raised berm between opposing directions of traffic will also limit the impact of headlight glare.

Figure D-43 43
The 'Area of Effective Vision' is expressed diagrammatically indicating a diminishing visual impact with increasing distance and greater angles away from the direction of travel.

Figure D-44 43
The area of effective vision will become longer and more directional with increased design speeds.

Figure D-45 43
When viewed from distances up to 5 km., where utility corridors cut through forest, screen the groundplane of the cleared right of way with vegetation and earthworks.

Figure D-46 43
Make revegetation of the utility corridor where it intersects the road a priority.

Figure D-47 44
Viewed from a distance of up to 5 km., where corridors cut through forests, screen the groundplane of the cleared right of way.

Figure D-48 44
In treed areas, viewed from distances up to 1.5 km., screen the powerline support structure.

Figure D-49 44
Do not align the road to focus on a powerline corridor at the end of a tangent.

Figure D-50 44
Intersect the powerline with the road at the perpendicular or at an angle no less than 30 degrees.

Figure D-51 44
In hilly or mountainous terrain, route the highway so that, from a distance of 0-1.5 km., the powerline, where it intersects the road, will not appear above the horizon line (eg. descending into a local low point with middleground backdrop).

Figure D-52 45
Where cut has occurred within 3 years and when viewed from a distance of 5-8 km, avoid alignments which focus the road on dominant lines of the cut.

Figure D-53 45
When viewed from within 1.5 km., screen the area of the cut in its entirety.

Figure D-54 45
Additional space is required to construct an adequate visual screen which could have concealed this timber cut.

Figure D-55 45
Set aside a 20 m wide visual screen within the right of way, exclusive of future road widening and clearing requirements, OR require a 20 m wide perpetually forested screen within the adjacent allocated timber license area.

Figure D-56 46
Align tangents away from those commercial uses which are unsightly. For business operations immediately adjacent to the road, provide room for a minimum 20 m wide vegetative buffer. Buffer may take the form of an earthwork berm if appropriate to local terrain.

Figure D-57 46
Buffers of native vegetation should be minimum 20m width in rural areas.

Figure D-58 46
Alignment does not allow sufficient room to screen these commercial billboards on private property. More signs are being erected in cleared areas to the right of the photograph. There is not sufficient right-of-way to establish a buffer zone.

Figure D-59 47
Some planting has been undertaken to screen this hydro installation. A more continuous planted buffer would have been more successful.

Figure D-60 47
Where highways are aligned on upper slopes recognize the opportunity to create spectacular viewpoints.

Figure D-61 47
Skirt open spaces which provide views (eg. agricultural or forest clearings or open spaces associated with water such as rivers, streams, oceans, lakes, reservoirs, marshes, bogs).

Figure D-62 47
Expose views for a minimum of 0.5 seconds for fleeting views, 5.0 seconds for panoramic views.

Figure D-63 48
Retain natural elements which provide a break from the view for a minimum of 0.5 seconds, at irregular intervals (5 minutes apart). maximum).

Figure D-64 48
Align road along forest edges. Forested conditions require alignment to respond to changes in vegetation type and density.

Figure D-65 48
Align roads parallel to hedgerows and make tangents focus on significant landmark trees.

Figure D-66 48
This maple retained within the median contributes to the overall quality of the highway and to the driver's experience.

Figure D-67 49
Expose road surface to direct sunlight from east and south directions by alignments skirting clearings, providing for feathering of vegetation on south and east, and decreasing amount of cut zones.

Figure D-68 49
Where aesthetics warrant vegetation close to the pavement, review early morning sun angles to minimize icing. Adjust alignment and/or vegetation to reduce problems as identified.

Figure D-69 50
In this photograph an ecologically well resolved culvert outflow needs additional care to create an aesthetically satisfactory solution.

Figure D-70 50
Roadway alignment should recognize and skirt sensitive habitat areas.

Figure D-71 51
Alignment should follow property boundaries where possible. Small, isolated parcels should be purchased for right of way.

Figure D-72 51
Borrow pits can be integrated into earthwork design within the right of way.

Figure E-1 54
Where clearing access routes cannot be contained within the right of way, separate the route from the highway by a 20 m buffer.

Figure E-2 55
During felling operations be careful not to disturb fragile areas.

Figure E-3 56
Initially, clear only the lines required for control line and cross section survey.

Figure E-4 56
Refine alignment to avoid special topography or features revealed during control line survey, prior to mass site clearing.

Figure E-5 56
Inspect the outer 10% of the proposed clearing to find landscape features which might be saved by minor readjustment to proposed grading.

Figure E-6 57
Prior to clearing the outer 10%, assess visual screen and noise abatement requirements.*

Figure E-7 57
Assess dead, dying and wind susceptible plantings, removing only those which pose a threat to the area within paving edge, future above ground utility lines, sight lines *and sight triangles.*"

Figure E-8 57
Finished clearing should respect objectives for visual, and environmental factors, in addition to engineering requirements.

Figure E-9 58
Vegetation closer to the highway can help slow down traffic where the design speed is reduced.

Figure E-10 58
Retain vegetation whose mature height will not exceed 600mm above the finished elevation of the highway.

Figure E-11 58
Selective clearing should be guided by highway safety requirements and aesthetic considerations.

Figure E-12 59
Clear lower limbs of overhanging trees to 5m clear height.

Figure E-13 59
Native vegetation retained within the median can help reduce the impact on oncoming headlights.

Figure E-14 60
Note how utility lines are concealed by Arbutus trees retained at the roadway edge.

Figure E-15 60
Retain vegetation along the shores of waterbodies.

Figure E-16 61
Vary the edge of the clearing line to create an undulating forest edge. Avoid a forest edge which has a regular undulating pattern. Keep undulations random, and similar to adjacent natural conditions.

Figure E-17 61
Retain undisturbed root zone as required to protect trees to remain from potential wind throw hazard.

Figure E-18 61
Tree clumps provide variety within forest clearings.

Figure E-19 61
Clearing should emulate the natural forest edge transition from grasses to shrubs to pioneer trees to mature forest.

Figure E-20 62
Clear sufficient length and at an angle to expose the view at the design speed.

Figure E-21 62
Limbing trees can offer filtered views.

Figure E-22 62
In long clearings, consider retaining specimens or clumps to break up the view.

Figure E-23 63
Minimize views to timber cuts uphill from the road.

Figure E-24 63
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Figure E-25 63
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Figure E-26 65
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Figure E-27 65
Native vegetation higher than 300 mm should be removed within a 5m radius of entrances to buildings or other structures.

Figure E-28 65
Where picnic tables are located in the woods, allow a minimum of 1 m between table pads and trees. In this example one of these tables should have been located further away from the existing trees.

Figure F-1 68
Remove landforms as required for safe sight distance.

Figure F-2 68
Borrow areas within the right of way can be shaped to resemble naturally occurring topography.

Figure F-3 68
This substantial fill disposal site is largely concealed from the highway because of the vegetation left at the roadway edge.

Figure F-4 69
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Figure F-5 69
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Figure F-6 69
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Figure F-7 70
Stockpile topsoil within the limits of cleared areas in well drained areas.

Figure F-8 70
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Figure F-9 70
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Figure F-10 71
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Figure F-11 71
Typical feathering of the ends of a slope.

Figure F-12 71
Typical rounding at top and bottom of slope.

Figure F-13 72
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Figure F-14 72
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Figure F-15 72
Grade around rock or rock outcrops so as to maintain a natural appearance.

Figure F-16 73
Typical 'bell-mouth' swale and related feathering.

Figure F-17 73
Design earthworks to avoid damage to trees and vegetation to be retained.

Figure F-18 73
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Figure F-19 74
Example of blasted rock face which simulates a natural rock outcrop.

Figure F-20 74
Example of a smooth wall blasted rock face incorporating benches for stability.

Figure F-21 75
Avoid excessive depth of ditches.

Figure F-22 75
Make ditch side slopes as flat as practical, and relate to adjacent terrain.

Figure F-23 75
Ditch alignments need not be parallel with the edge of pavement. Ditches should respond to adjacent terrain.

Figure F-24 75
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Figure F-25 76
Blend created ponds or created retention basins to simulate naturally occurring depressions.

Figure F-26 76
Minimize the visual impact of ditches and steepness of slopes in medians.

Figure F-27 76
Typical culvert end with concrete flare. See Figure A-4 for alternate example.

Figure F-28 77
Construct berms with a varying height, length and alignment to avoid visual monotony.

Figure F-29 78
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Figure F-30 78
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Figure F-31 79
Elevation of typical retaining structure.

Figure F-32 79
Section through typical retaining structure.

Figure F-33 80
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Figure F-34 80
Emphasize design speed changes with earthworks.

Figure F-35 81
Align ditches at roadside facilities to be the least visible, usually at the site perimeter.

Figure F-36 81
Earthwork techniques can emphasize roadway speed limits and reduce pedestrian/vehicle conflicts.

Figure G-1 84
Once rough grades have been established topsoil will be spread to depths required to ensure adequate plant growth.

Figure G-2 85
Vegetation within the area of sight triangles should be kept less than 300 mm height above the level of pavement. Refer to the Ministry of Transportation and Highways Landscape Policy.

Figure G-3 86
Where attractive views exist, limit the height of foreground vegetation.

Figure G-4 86
Note that revegetation undertaken within the darkly shaded areas of this 'Area of Effective Vision' diagram will be more effective in screening and framing views.

Figure G-5 87
Revegetate to screen at convergence of alignments and between highway and frontage roads which parallel within 20m.

Figure G-6 87
Revegetate the open ends of tangents.

Figure G-7 88
Screen the view to utility corridors when viewed from a distance of within 5km.

Figure G-8 88
Alignments which expose timber cuts within 5km of the roadway will negatively impact the aesthetic quality of the driving experience.

Figure G-9 89
Typical screen between roadway and unsightly adjacent land use.

Figure G-10 89
For unsightly land uses, provide a 20m minimum planted buffer.

Figure G-11 89
For normal commercial business screen parking areas and yard operations.

Figure G-12 89
Where screening of businesses cannot be accomplished, consider providing of alternate visual focus.

Figure G-13 90
Typical planting at the base of bridge and overpass support structures.

Figure G-14 90
Provide shrub planting between median traffic barriers.

Figure G-15 90
Provide for revegetation at the base and/or top of retaining structures.

Figure G-16 90
Provide planting within traffic islands and interchange loops.

Figure G-17 91
Revegetation developed in conjunction with adjacent landholders should provide a buffer between the highway and adjacent commercial or residential interests.

Figure G-18 92
Revegetation should consider and respond to the character of existing vegetation.

Figure G-19 92
The crown vetch used as groundcover in this photograph blends with the surrounding context.

Figure G-20 92
Undulate the forest edge.

Figure G-21 93
Fragment the forest edge.

Figure G-22 93
Feather the forest edge.

Figure G-23 93
Revegetation should create a transition from grasses through to mature trees.

Figure G-24 94
A dense groundcover can reduce erosion and assist in the stabilization of cut and fill slopes.

Figure G-25 94
For large areas seed mixtures can be applied by hydroseeders.

Figure G-26 95
In this situation grasses have not established. Deep rooting perennials are needed for this application.

Figure G-27 95
Additional slope stability is provided by using aggressively rooting plants and layering in plant material.

Figure G-28 96
In areas where snow drifting caused by high winds is an issue trees should be set back from the edge of pavement.

Figure G-29 97
Vegetation can supplement other forms of noise abatement.

Figure G-30 97
Where roadways pass close by residential areas revegetation should provide a screen against headlight glare.

Figure G-31 98
Note setback distances from trees in this rural situation.

Figure G-32 98
Note setback distances from trees in this urban situation.

Figure H-1 101
Note good fit of retaining structure into its setting, and skilful use of drystone wall, seeded wildflower and trees.

Figure H-2 101
Select materials which may be indicative of the region in which the structure is placed.

Figure H-3 102
Consider retaining walls where fills exceed 80% of the height of adjacent vegetation.

Figure H-4 102
The wall in the background allows the vegetation downslope to be retained. The foreground shows the impact without the wall.

Figure H-5 102
Bridging streams whenever possible is preferable to installing culverts. Bridges maintain the continuity of the watercourse and help to minimize the impact of highway construction on natural systems.

Figure H-6 103
The impact of this bridge was reduced by splitting the structure and allowing more light below.

Figure H-7 104
Curvilinear forms are softer and more in context with rural landscapes.

Figure H-8 104
Suspension bridges can have a dramatic and positive landscape impact.

Figure H-9 105
This large bridge structure is designed with a muted colour so that it blends with the hillside in the background.

Figure H-10 105
This retaining wall has not taken into consideration the characteristics of the surrounding landscape and the strong white colour has a dramatically negative impact.

Figure H-11 106
A well designed culvert headwall - appropriate to a highly visible parkway site.

Figure H-12 106
This retaining structure is well textured with linear planting strips and vegetation. This scale of detail is appropriate when viewed at highway speeds.

Figure H-13 106
Stone veneer in process. This would be appropriate on a Parkway project, or area of close public inspection.

Figure H-14 106
This lock-block with stone finish would be appropriate for a tourway project.

Figure H-15 107
A good example of repetition of form and texture.

Figure H-16 107
This bridge structure will have the dominant vertical form of the piers repeated.

Figure H-17 108
The balustrade of this bridge has repeating accents. These aesthetic features can be adapted to the safety requirements of modern bridges.

Figure H-18 109
Parallel structures should be designed as matching sets, even if constructed in different phases.

Figure H-19 109
Bridge handrails are the most visible part of the bridge structure and should receive special design attention.

Figure H-20 110
Example of a rural bridge slope finished to allow ease of maintenance.

Figure H-21 110
Example of a more urban bridge abutment.

Figure H-22 110
Provide pullouts or other recreation amenities associated with beautiful structures.

Figure H-23 112
When possible, locate retaining walls downslope from the highway, to reduce visual impacts from the highway.

Figure H-24 112
Viewed from the road this retaining structure is completely hidden.

Figure H-25 112
An example of a retaining structure using locally available materials.

Figure H-26 114
The provision of a wide and varied median could have avoided the requirement for a continuous traffic barrier.

Figure H-27 114
Avoid the use of paint on concrete traffic barriers

Figure H-28 114
Locate traffic barriers to minimize their visual predominance.

Figure H-29 115
Consider installation of "see-through" forms of traffic barrier where views below the highway are frequent.

Figure H-30 116
Bicycle routes can be developed as an integral part of the highway.

Figure H-31 116
Bicycle routes can be constructed as separate alignments where the conditions and level of use warrant.

Figure H-32 116
The dimensions of a cyclist.

Figure H-33 117
With the Shared Roadway alignment motorists and bicyclists share the same lanes.

Figure H-34 117
A smooth paved shoulder along rural highways can be signed as a bicycle route.

Figure H-35 117
Bike lanes have preferential use for cyclists.

Figure H-36 117
Bike paths with separate alignment are preferable in Tourway and Parkway situations.

Figure H-37 118
Minimize the use of paint on curbs, or develop higher maintenance standards to minimize peeling, cracking condition.

Figure H-38 118
Decorative paving should be installed in traffic islands and medians where space is insufficient to allow planting.

Figure H-39 120
Wood post and agricultural style woven wire are appropriate for wildlife fencing. Note that fencing is routed through the trees in some cases.

Figure H-40 121
Consolidate several signs onto a single support structure. Signs and sign lighting enclosures should be of equal length to create a clean silhouette.

Figure H-41 121
Avoid locating signs where they obstruct views.

Figure I-1 126
Typical Class A Safety Rest Area Schematic Plan. Note: Each Rest Area plan must respond to the local site.

Figure I-2 126
Class A Safety Rest Area.

Figure I-3 127
Typical Class B Safety Rest Area Schematic Plan. Note: Each Rest Area plan must respond to the local site.

Figure I-4 127
Class B Safety Rest Area.

Figure I-5 128
Typical Class C Safety Rest Area Schematic Plan. Note: Each Rest Area plan must respond to the local site.

Figure I-6 128
Class C Safety Rest Area

Figure I-7 129
Typical Pullout Schematic Plan. Note: Each pullout plan must respond to the local site.

Figure I-8 129
Typical Pullout.

Figure I-9 137
Include provision for handicapped access and enjoyment in rest areas. Note the extended table top and slab at this table.

Figure I-10 137
Good relationship between parking and picnic area - convenient, but with some separation.

Figure I-11 137
A custom designed building for a rest area.

Figure I-12 138
Create curbed islands and curvilinear entrance roads.

Figure I-13 138
Avoid excessively large parking areas for car parking.

Figure I-14 139
Provide interpretive display and photo opportunity.

Figure I-15 139
Marsh outlook. Note deck to control access to marsh.

Figure I-16 139
A scenic overlook without adequate protection for pedestrians.

Figure I-17 139
A scenic overlook with reasonable pedestrian protection. Note innovative combination of post barriers and signage

Figure I-18 139
Interpretive signage grouped at the end of a short secondary path.

Figure I-19 140
Primary path to building and site features.

Figure I-20 140
Secondary path located away from major circulation area.

Figure I-21 140
Tertiary path. Note closeness to nature in this path.

Figure I-22 140
Tertiary path. Emphasis in tertiary path design should be on exposing the natural attributes of the site.

Figure J-1 147
In this example utility poles have been located away from the highway to preserve a particularly important view adjacent to a tourist facility.

Figure J-2 147
In this example utility poles have been located on the outside of a curve within the area of effective vision.

Figure J-3 147
This situation is much better where utility poles are not within the area of effective vision.

Figure J-4 148
Locate poles and standards on curve and/or tangent to side of road away from significant views.

Figure J-5 148
Locate poles and standards to the inside curve, where views are equal.

Figure J-6 148
When views along tangents are equal, locate standards and poles to the side opposite the approaching curve's predominant view.

Figure J-7 149
Consider attaching utility lines to cliff faces.

Figure J-8 149
Locate lines behind a vegetative screen where lines must follow topography.

Figure J-9 150
Lighting for signage should match the length, scale and colour of the sign.

Figure J-10 151
Illuminating this water cascade and bridge structure will create an interesting night driving experience.